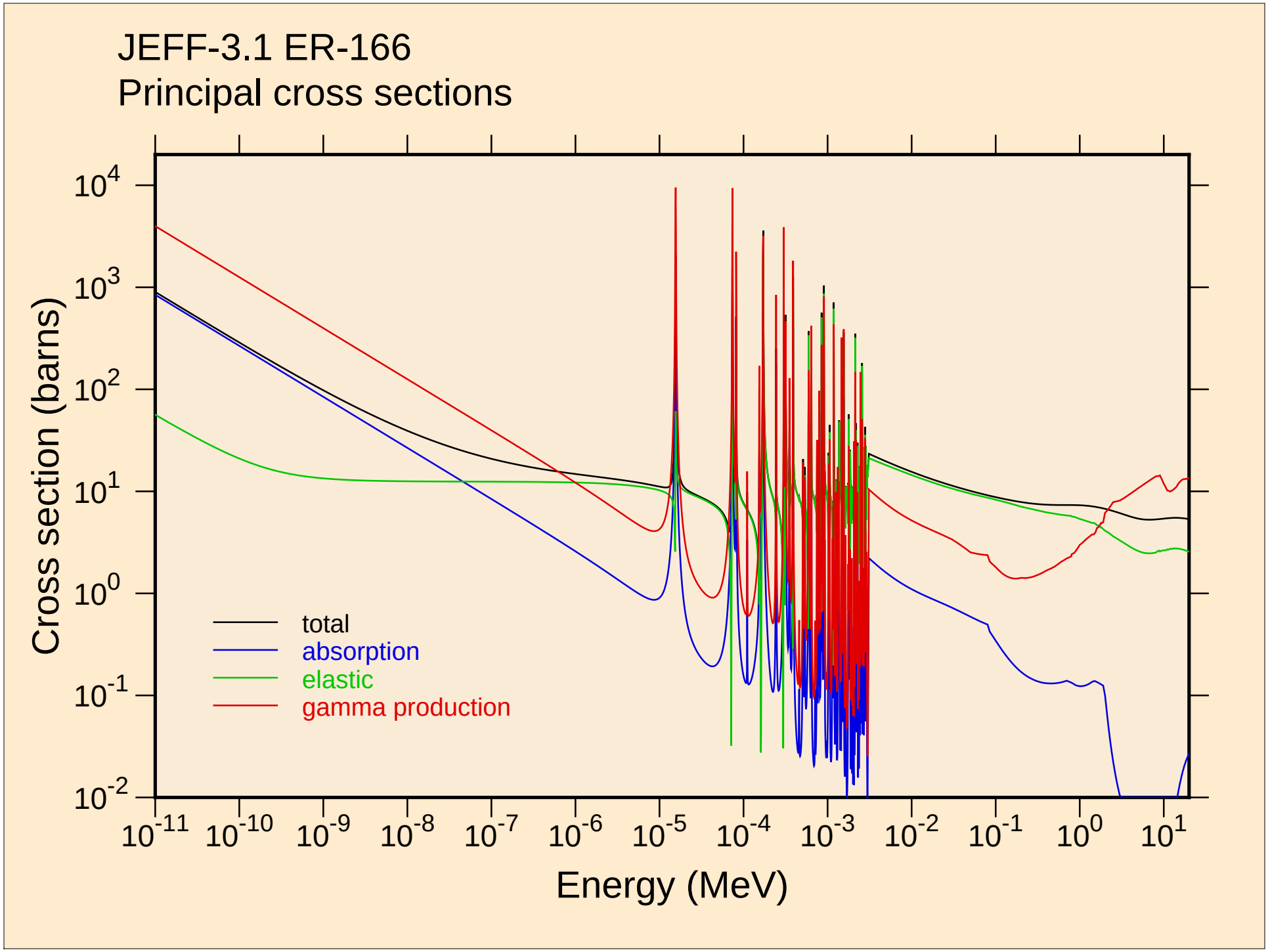
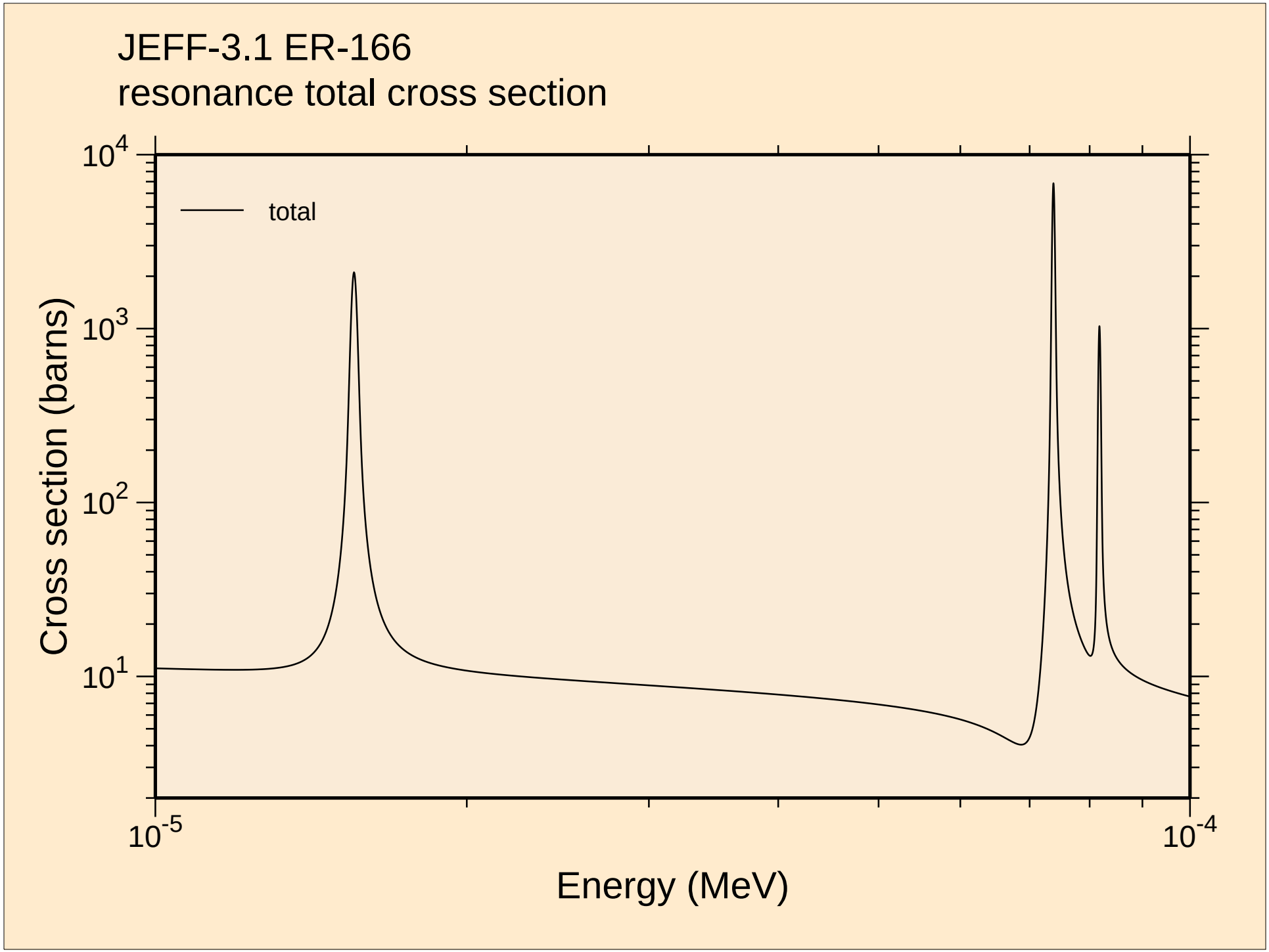
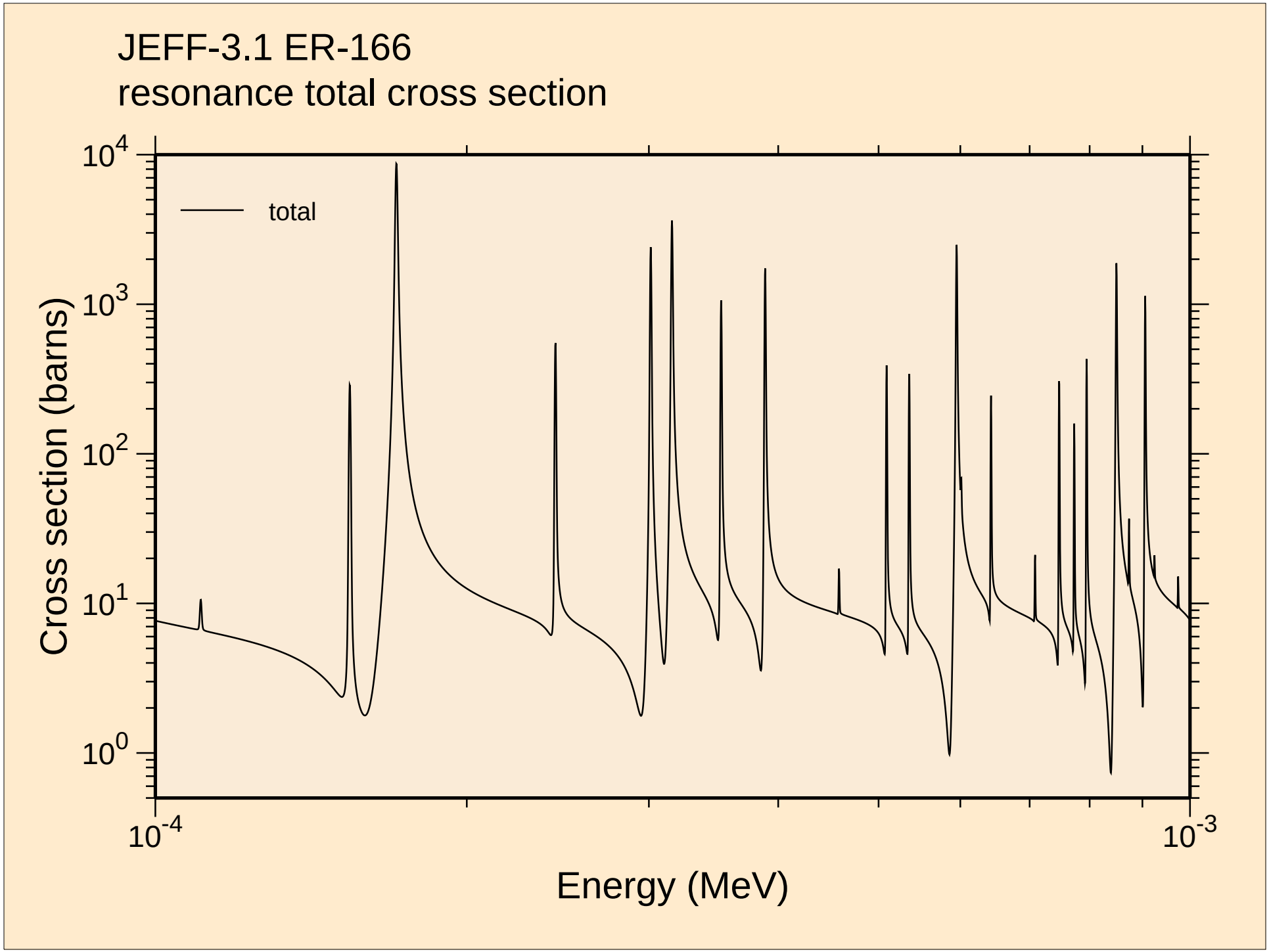
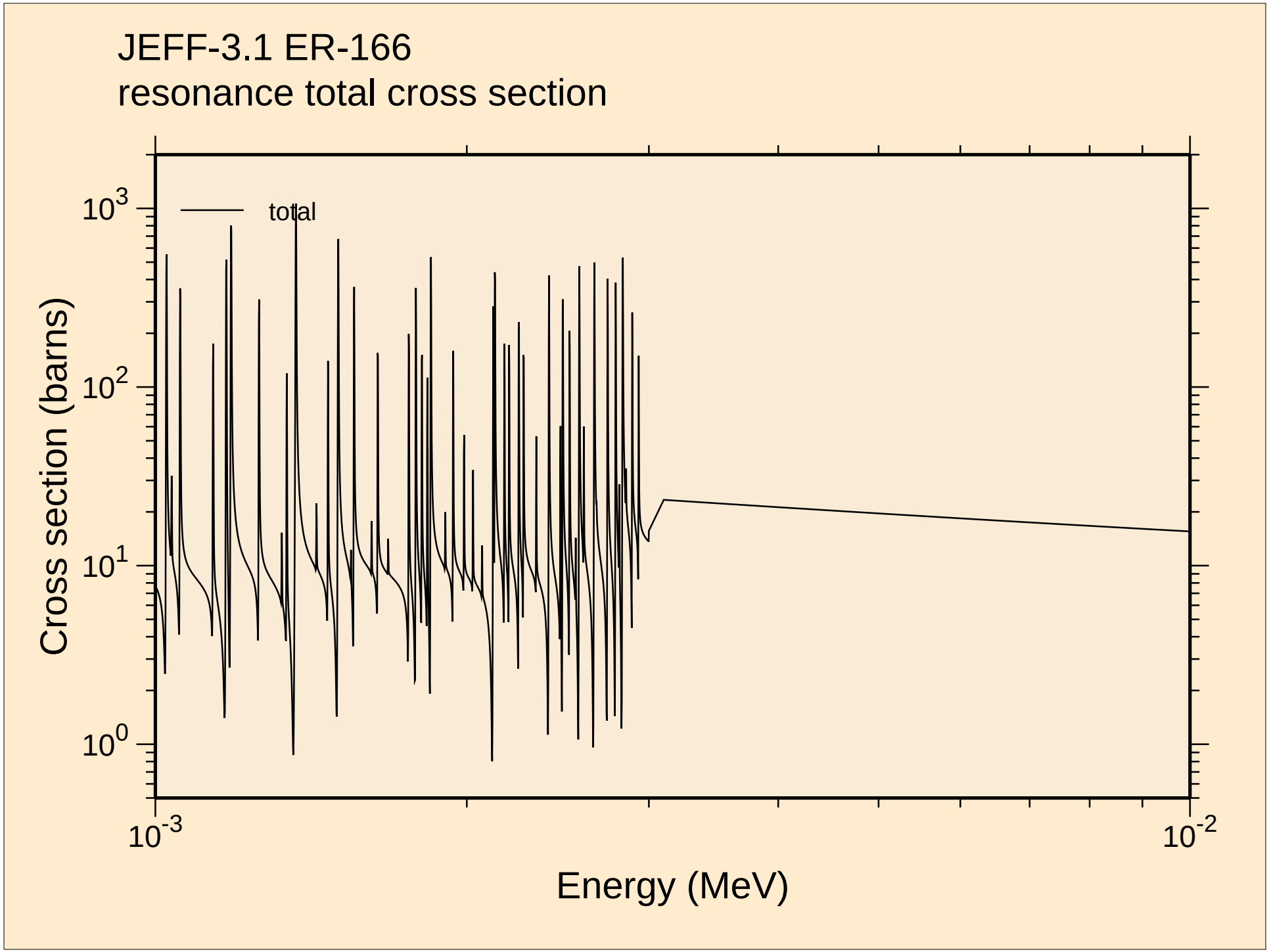
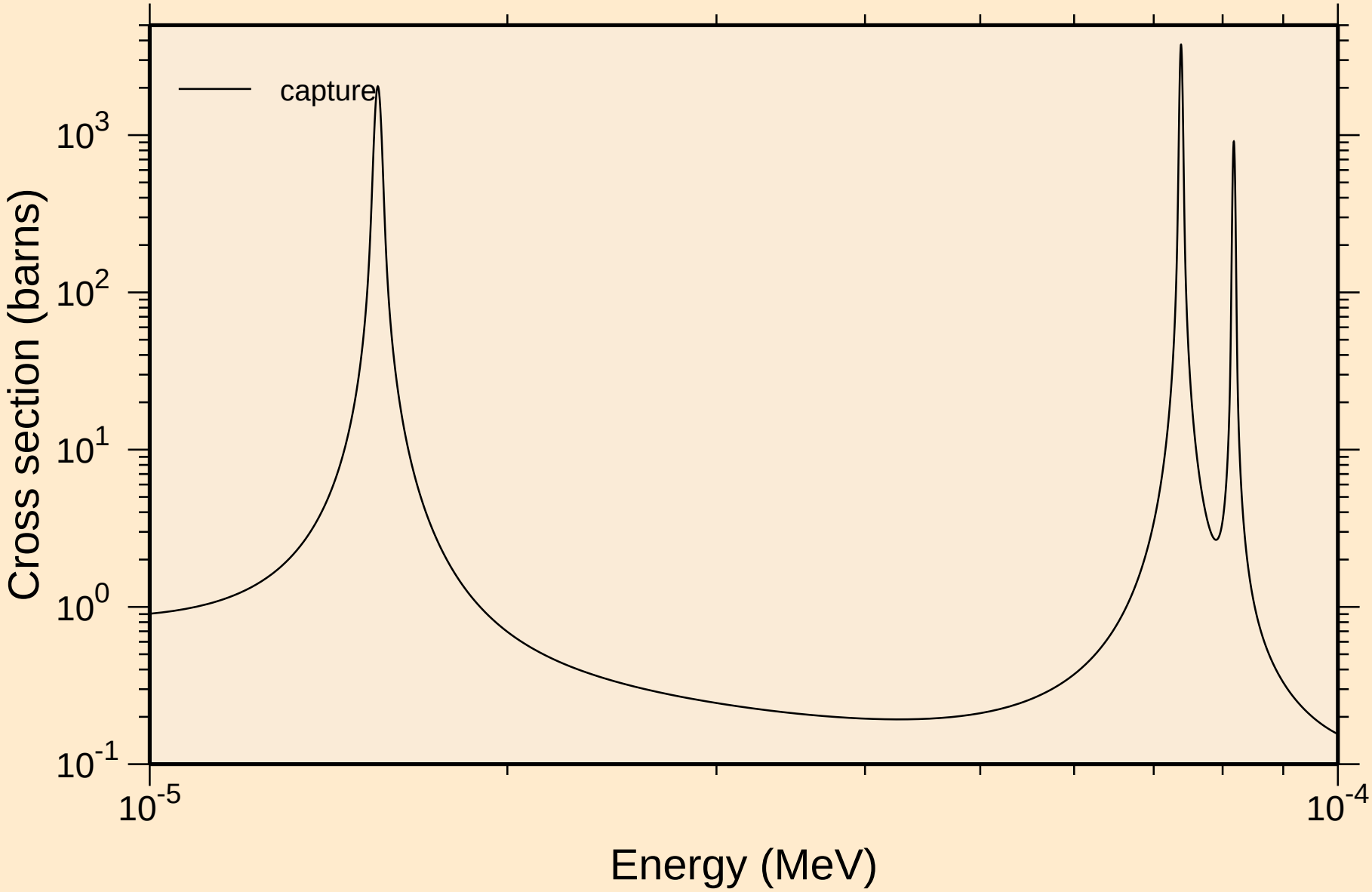

JEFF-3.1 ER-166
Principal cross sections
Cross section (barns)
Energy (MeV)
total
absorption
elastic
gamma production
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-11
10^-10
10^-9
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2
10^-1
10^0
10^1


JEFF-3.1 ER-166
resonance total cross section
total
Cross section (barns)
10^4
10^3
10^2
10^1
10^{-5}
10^{-4}
Energy (MeV)

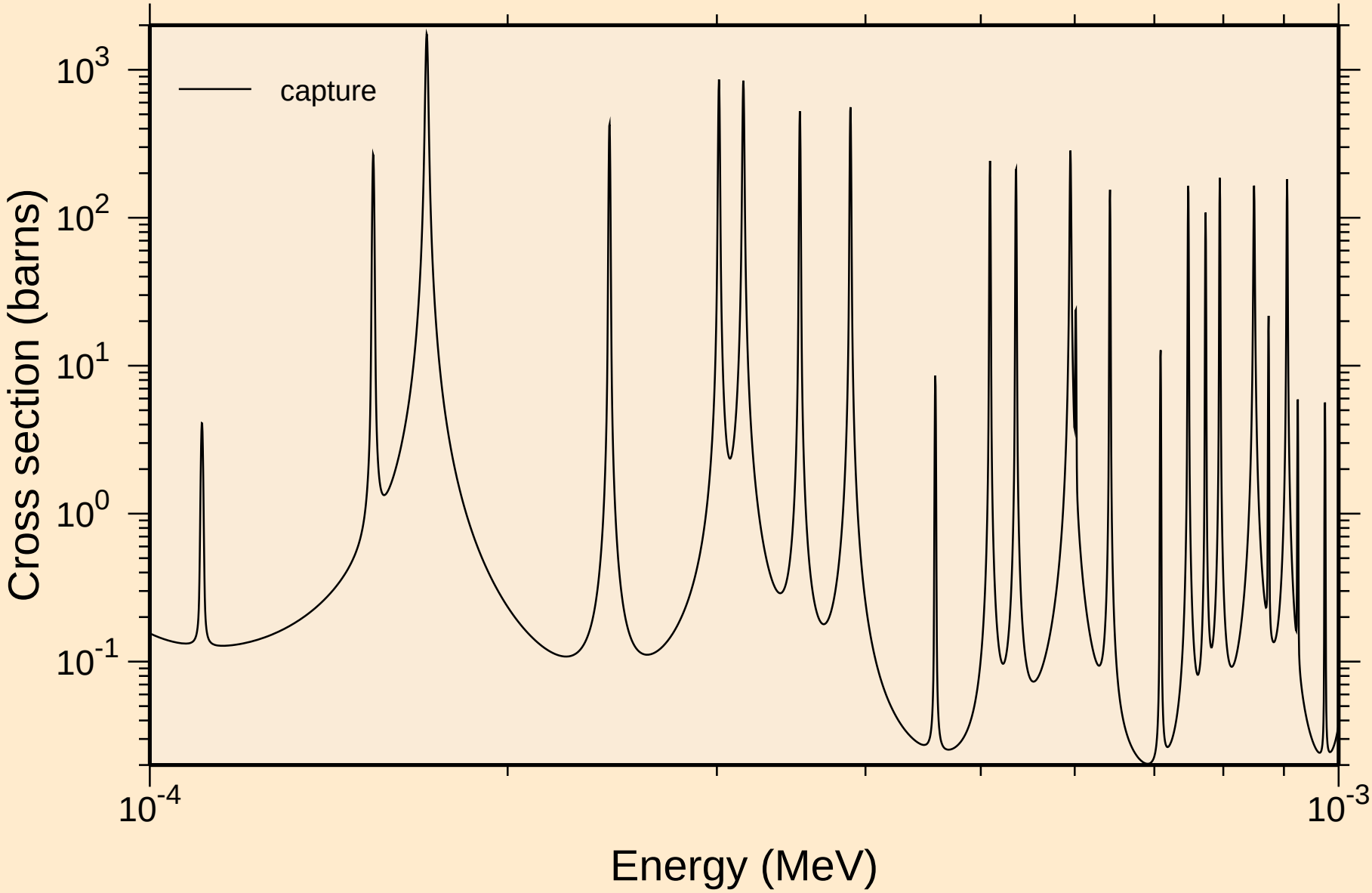

JEFF-3.1 ER-166
resonance total cross section
total
Cross section (barns)
10^4
10^3
10^2
10^1
10^0
10^{-4}
10^{-3}
Energy (MeV)

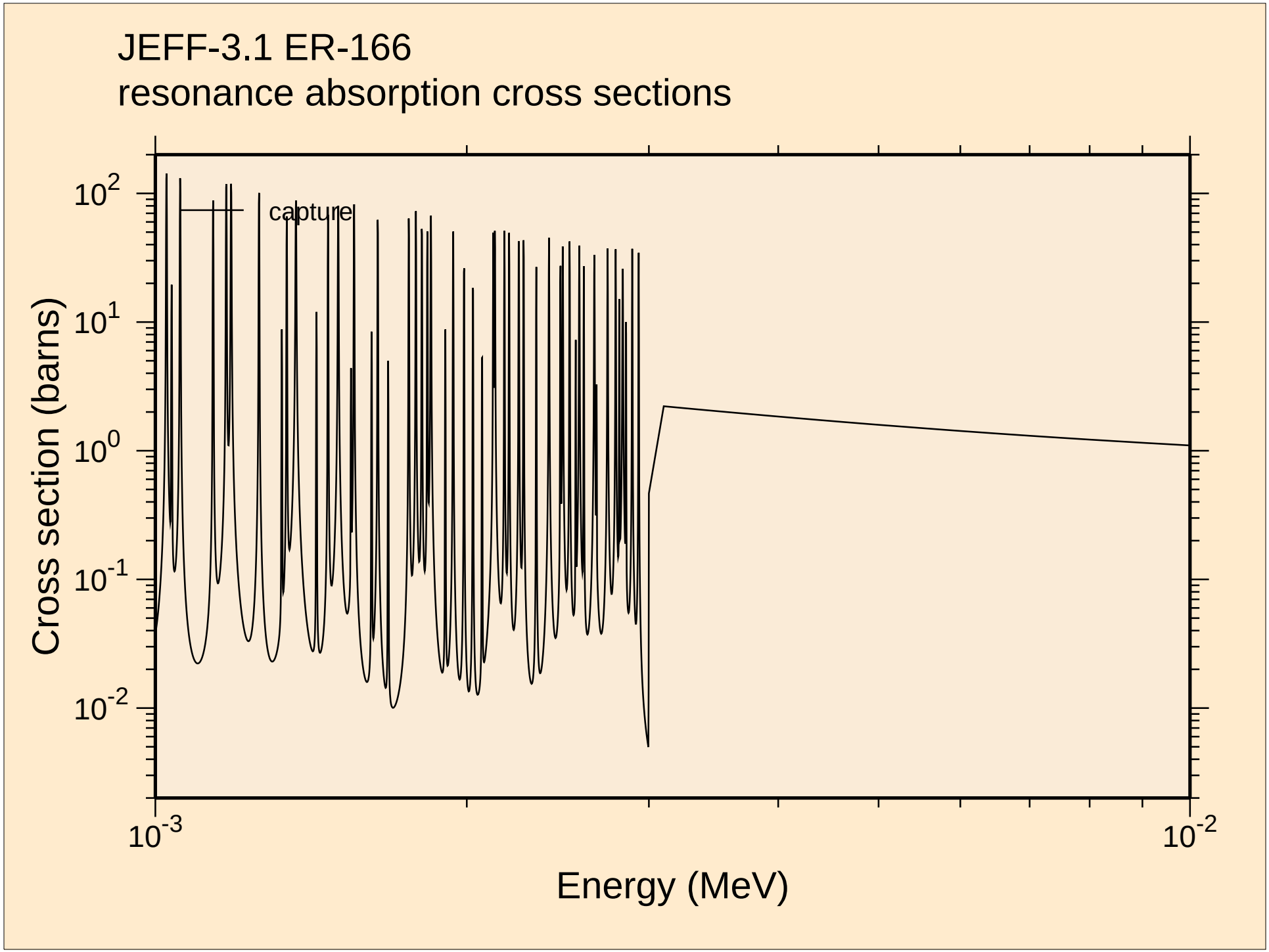

JEFF-3.1 ER-166
resonance total cross section
total
Cross section (barns)
10^3
10^2
10^1
10^0
10^{-3}
10^{-2}
Energy (MeV)

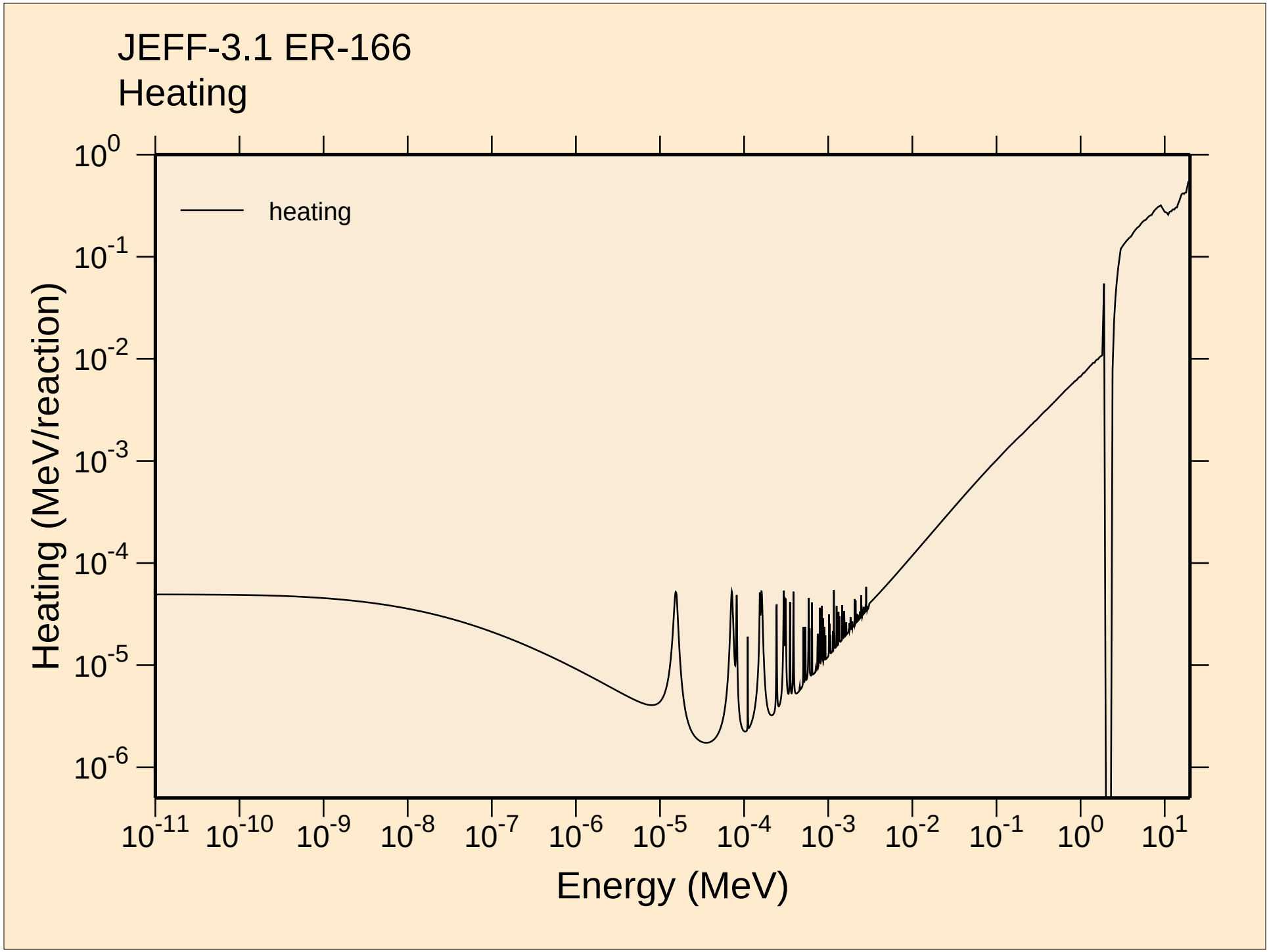
JEFF-3.1 ER-166
resonance absorption cross sections

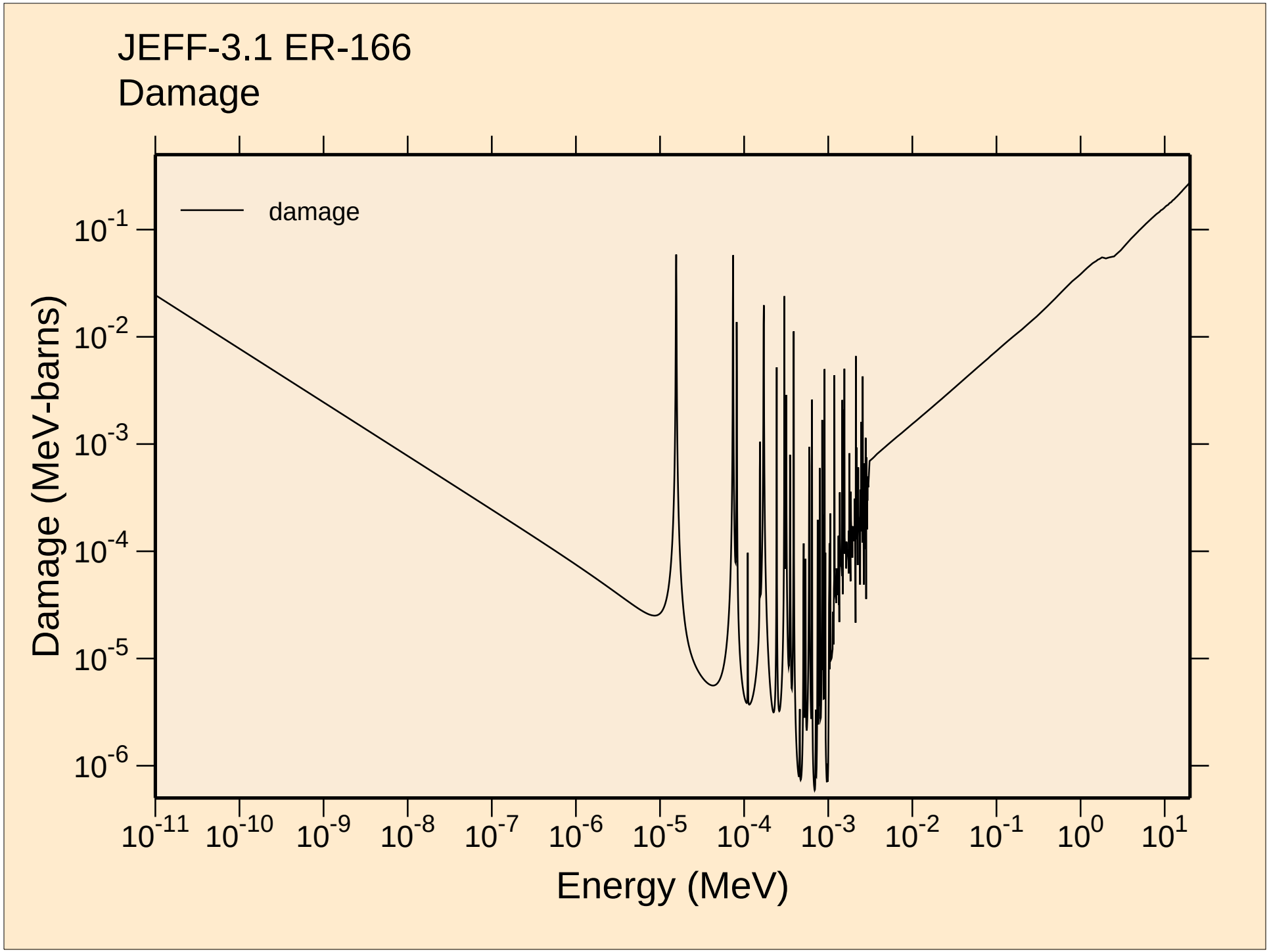


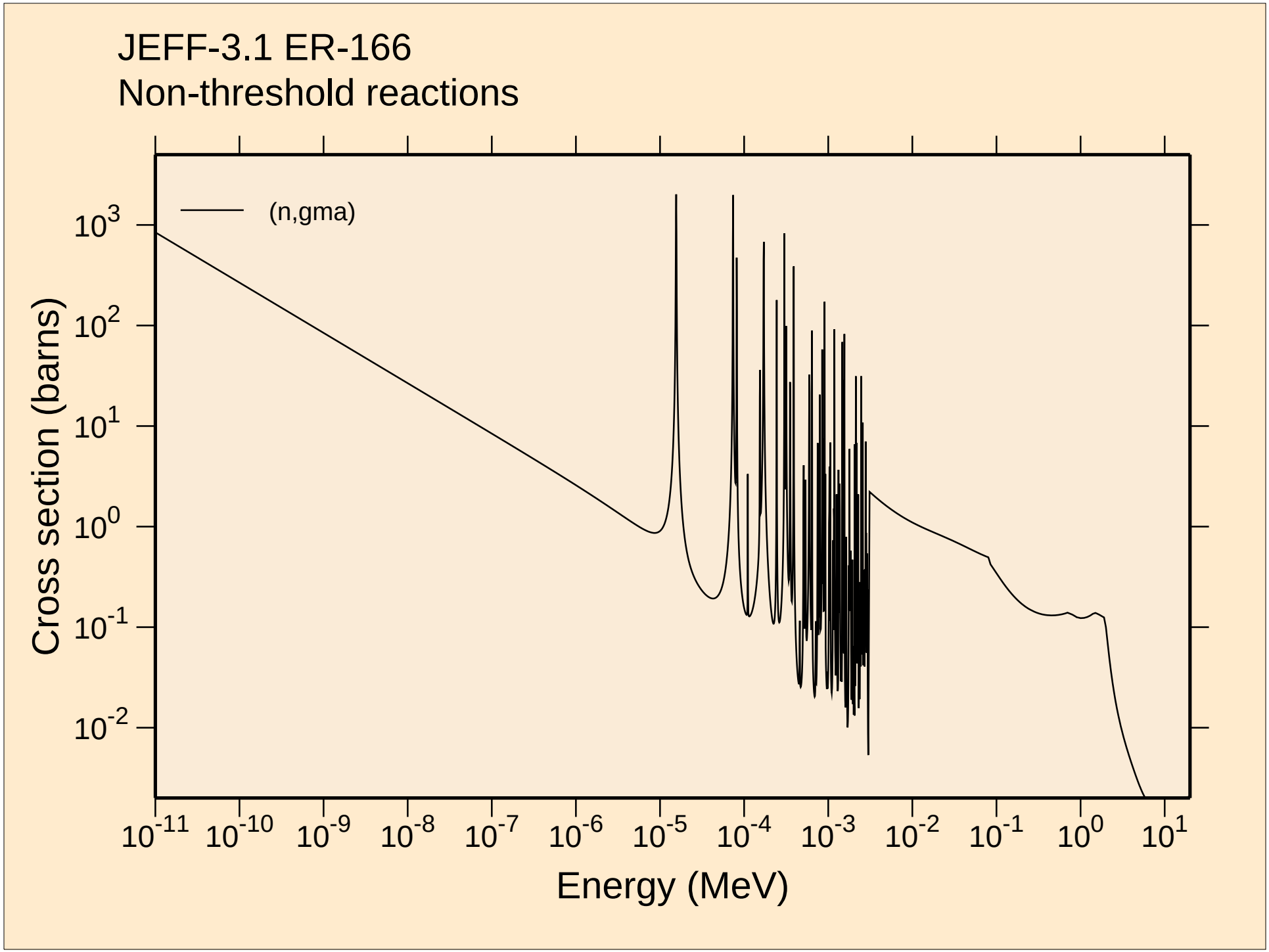
JEFF-3.1 ER-166
resonance absorption cross sections

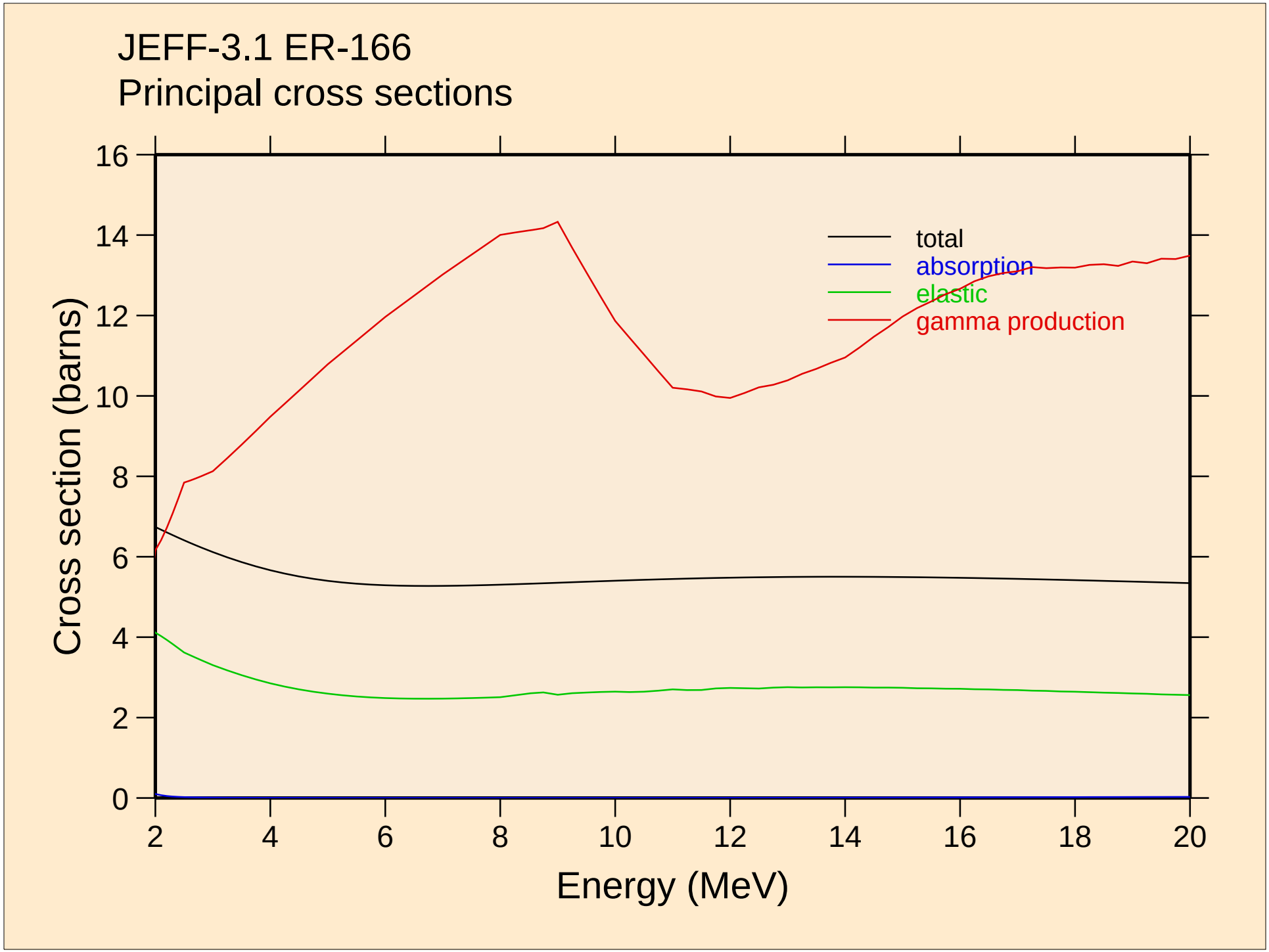


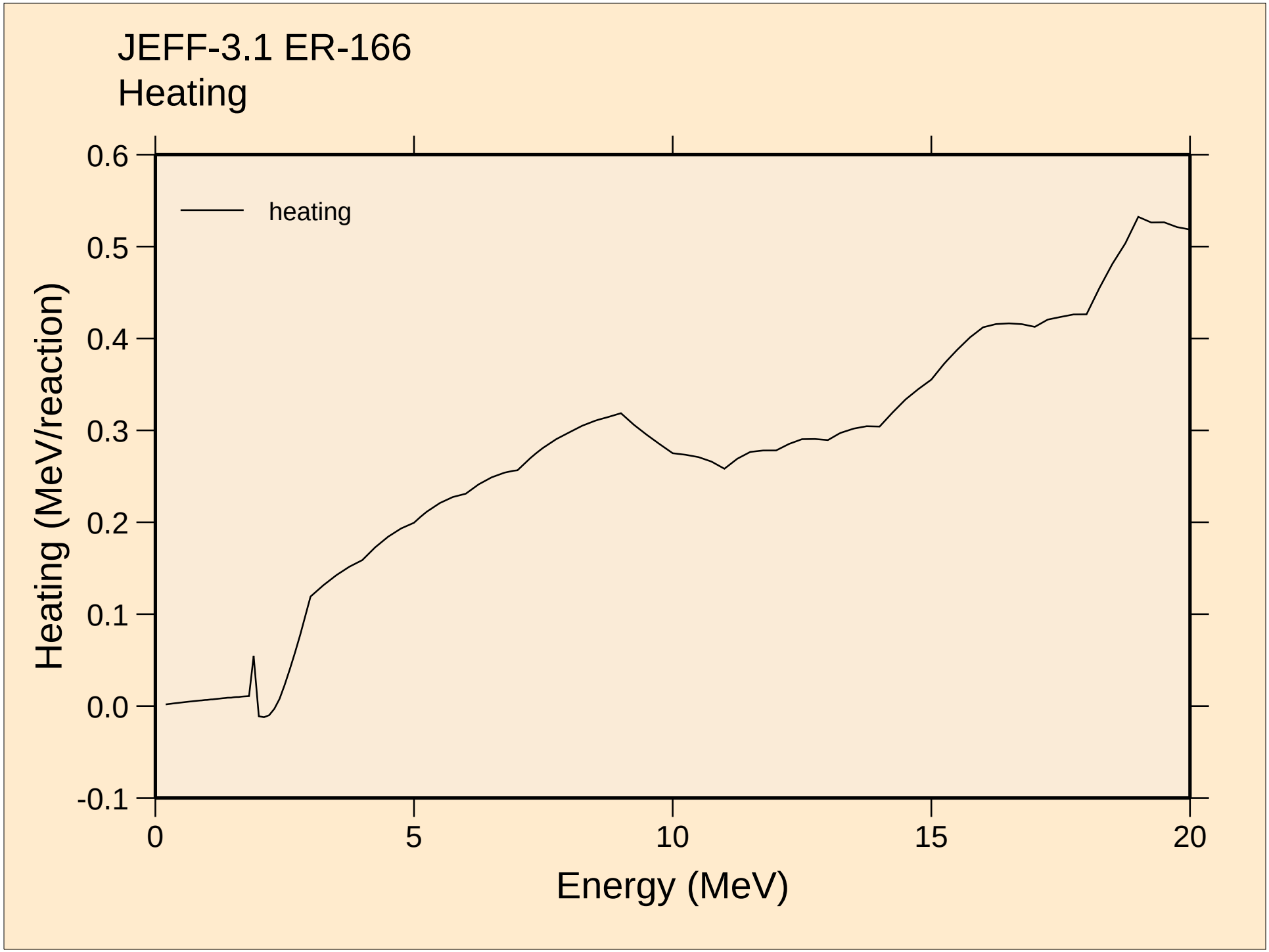

JEFF-3.1 ER-166
resonance absorption cross sections
capture
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-2}
Energy (MeV)

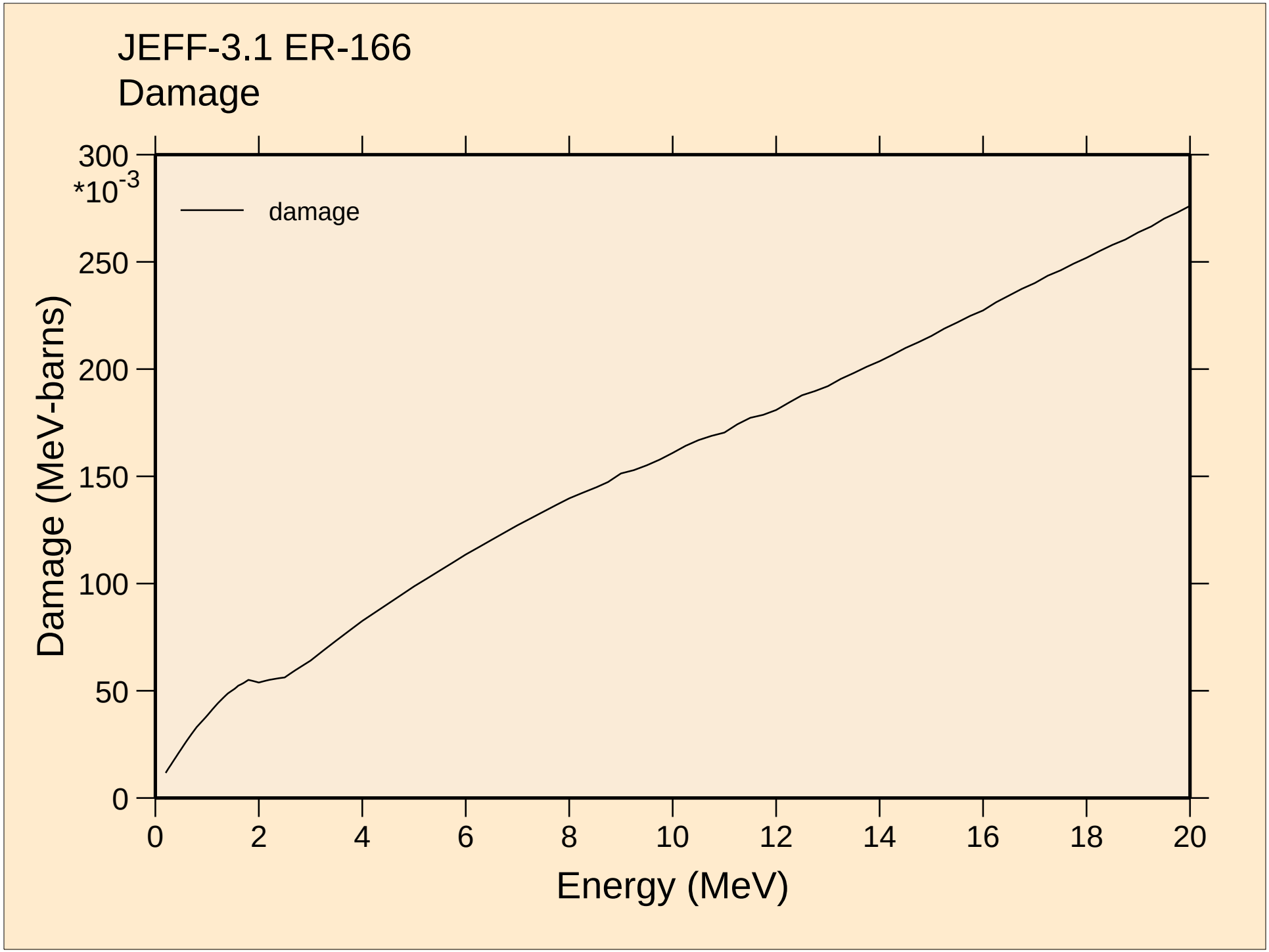

JEFF-3.1 ER-166
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-11
10^-10
10^-9
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2
10^-1
10^0
10^1

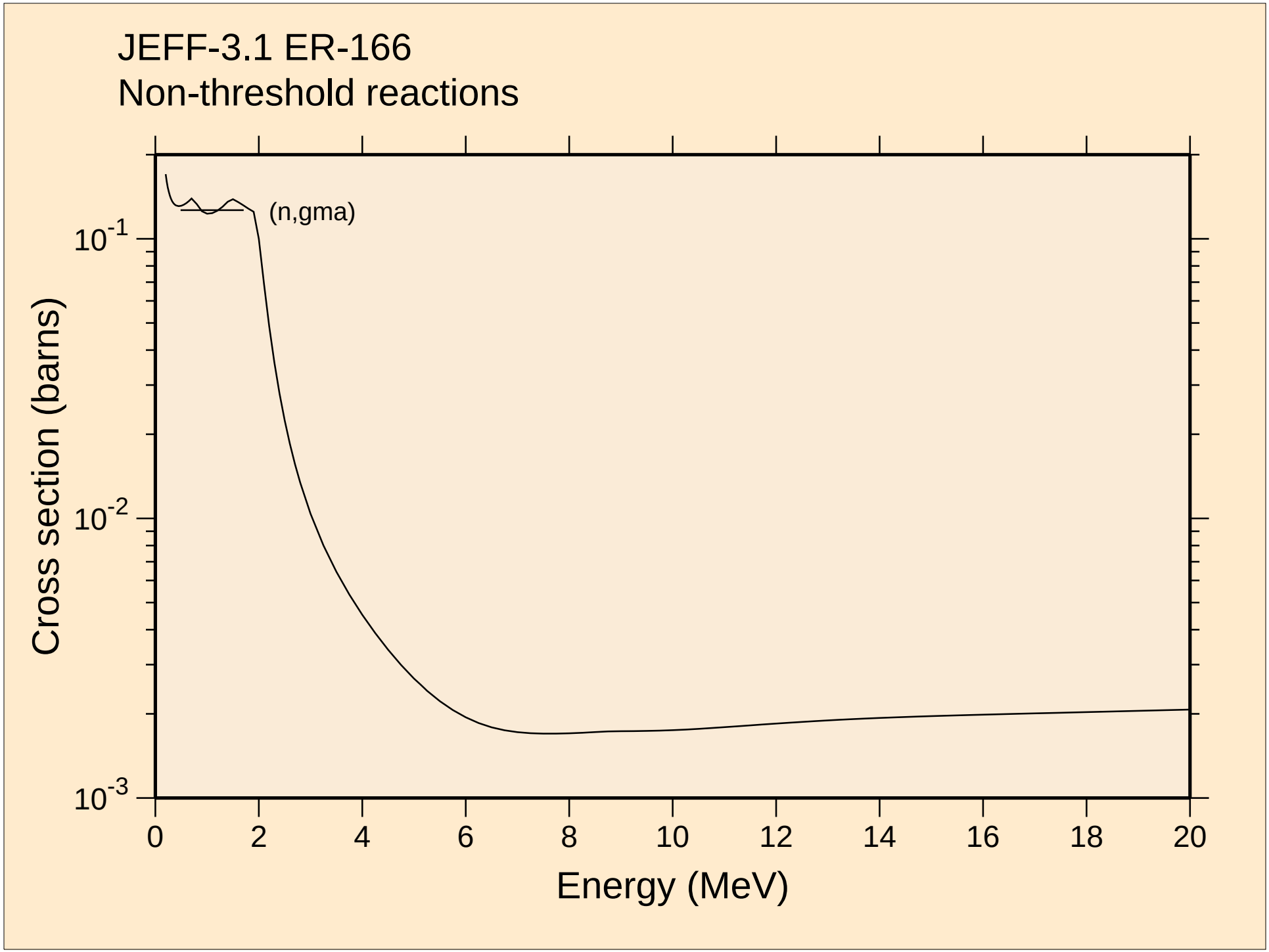

JEFF-3.1 ER-166
Damage
damage
Damage (MeV-barns)
10-1
10-2
10-3
10-4
10-5
10-6
10-11 10-10 10-9 10-8 10-7 10-6 10-5 10-4 10-3 10-2 10-1 100 101
Energy (MeV)

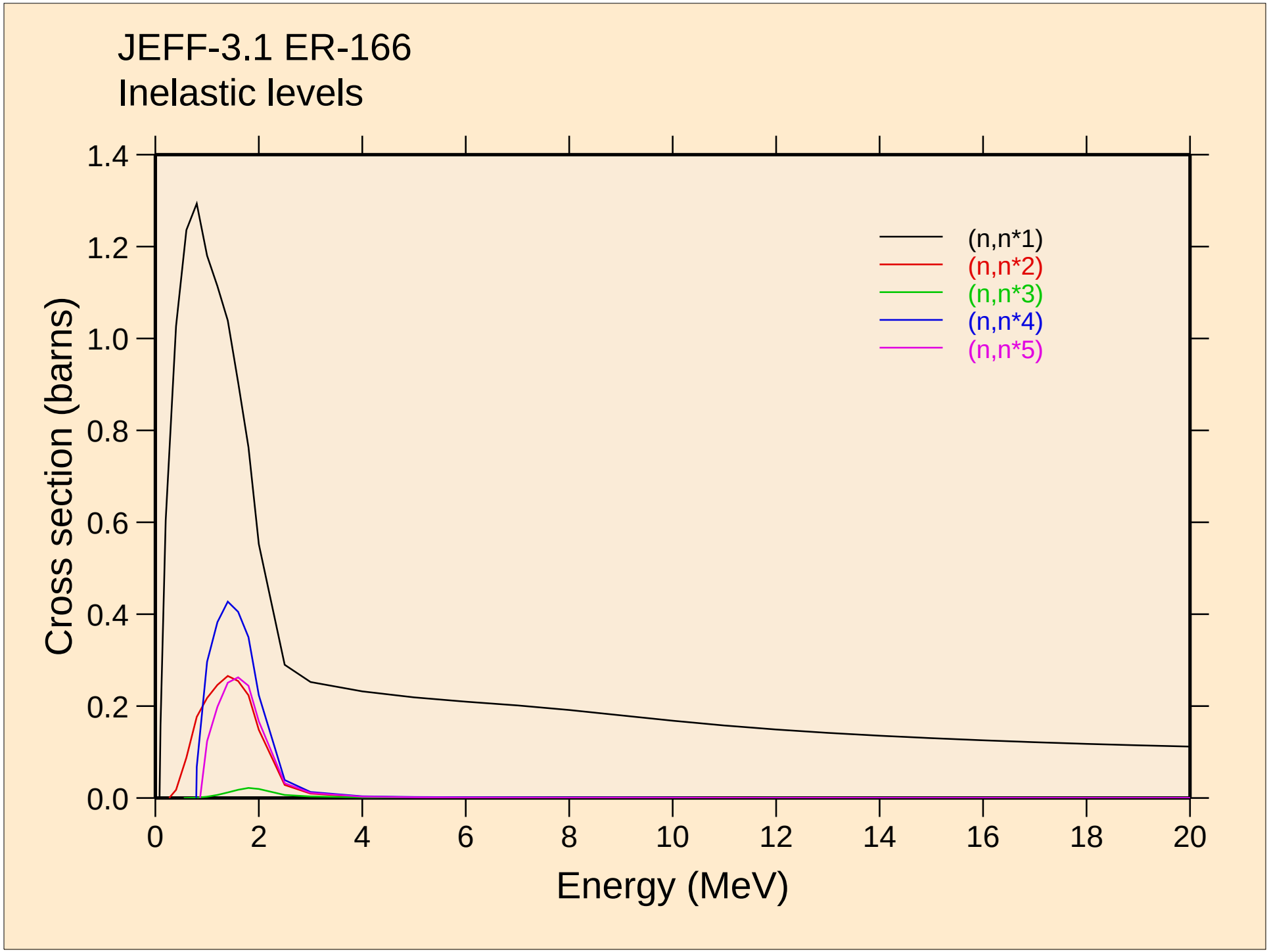

JEFF-3.1 ER-166
Non-threshold reactions
(n,gma)
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-11 10^-10 10^-9 10^-8 10^-7 10^-6 10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1
Energy (MeV)

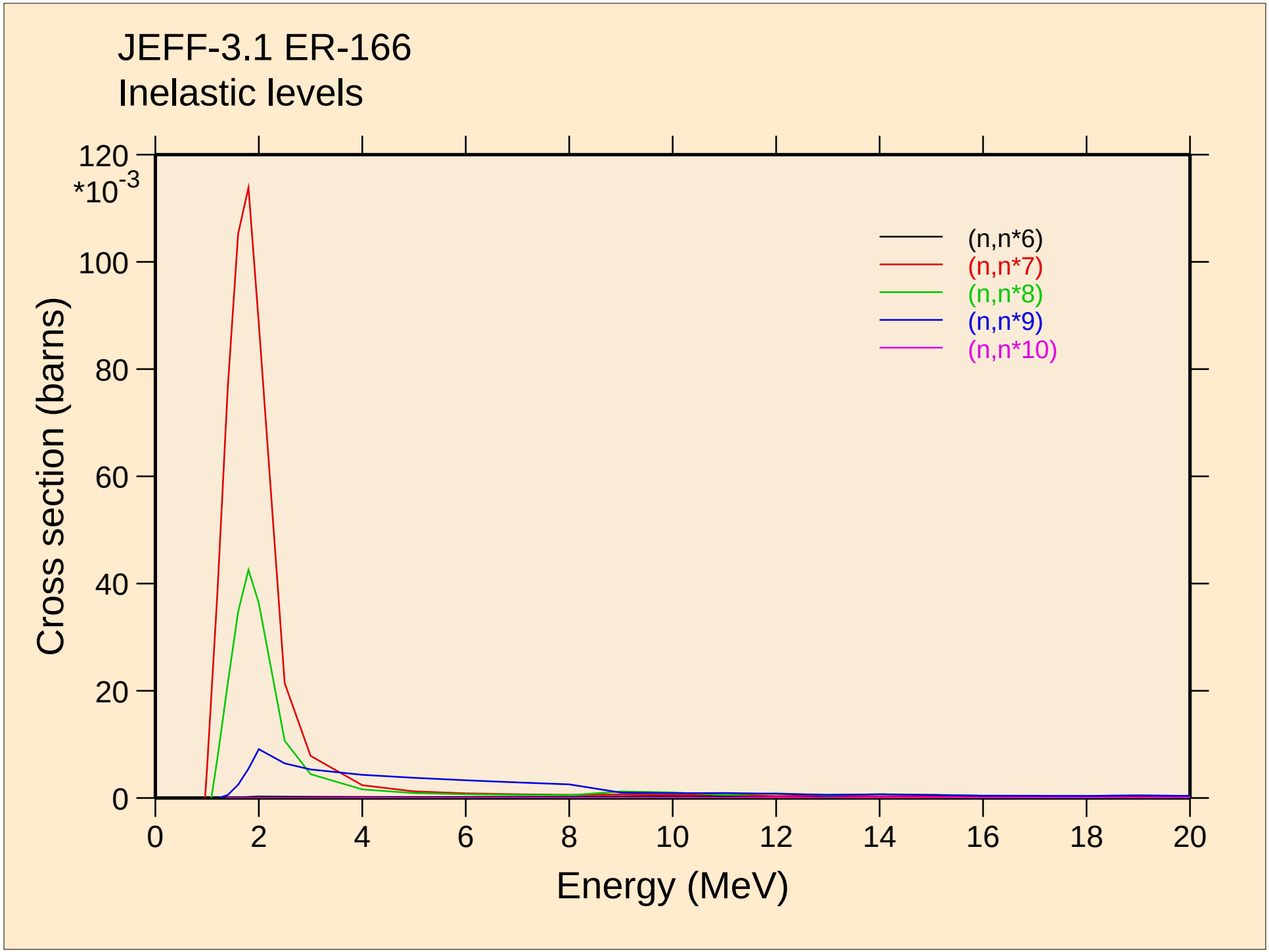

JEFF-3.1 ER-166
Principal cross sections
Cross section (barns)
Energy (MeV)
total
absorption
elastic
gamma production
0
2
4
6
8
10
12
14
16
2
4
6
8
10
12
14
16
18
20

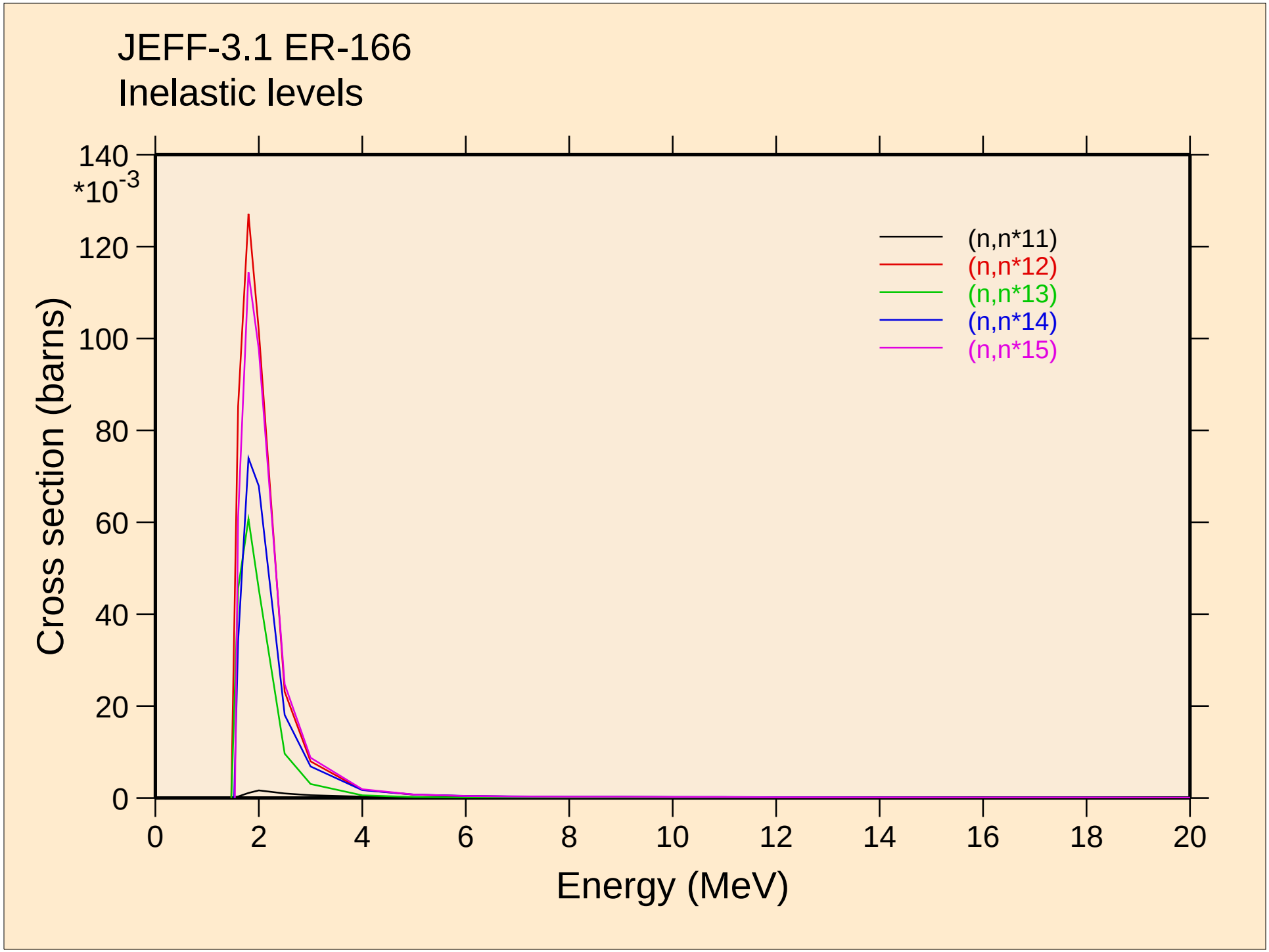

JEFF-3.1 ER-166
Heating
heating
Heating (MeV/reaction)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
0
5
10
15
20
Energy (MeV)

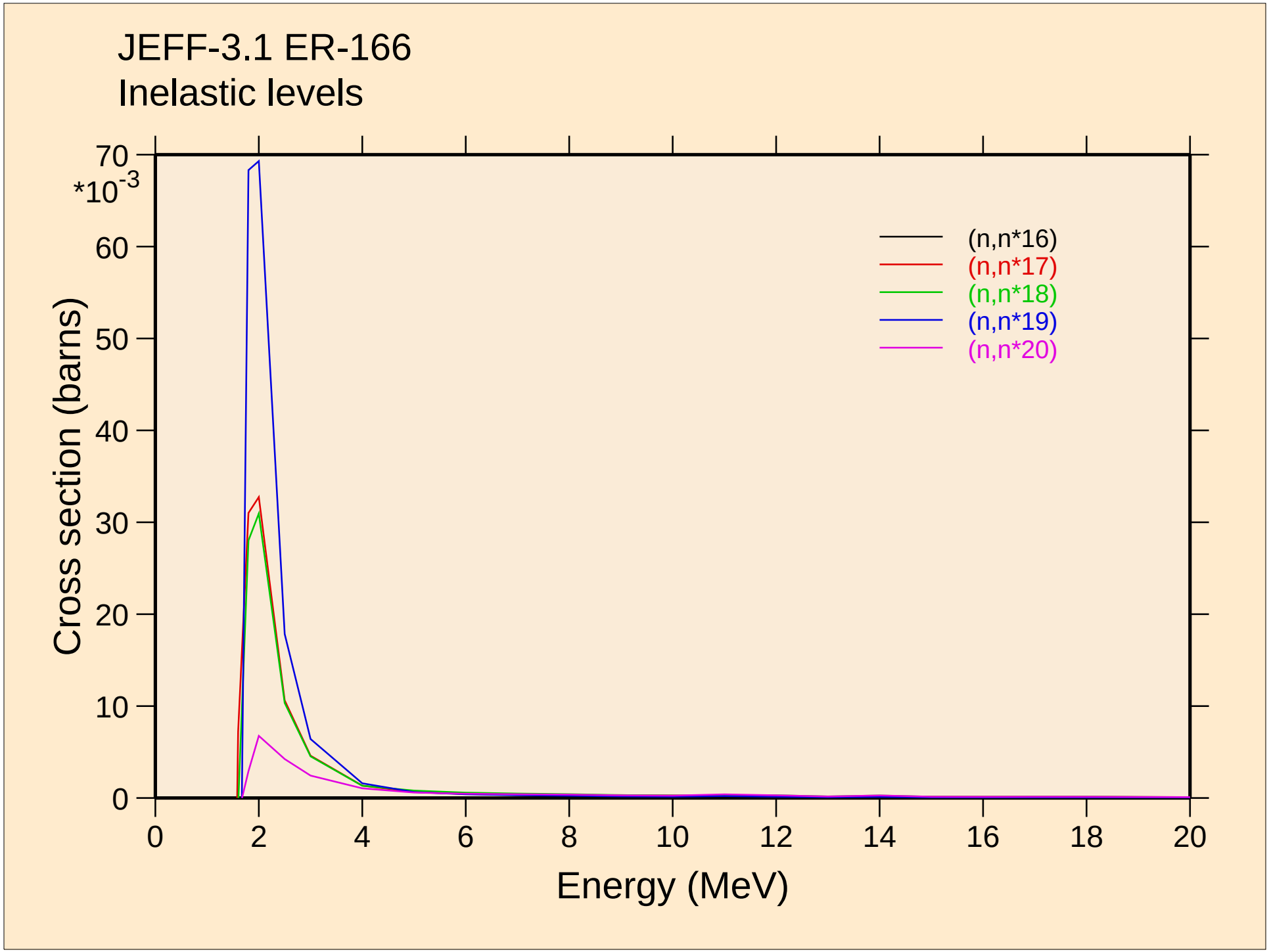

JEFF-3.1 ER-166
Damage
300
*10-3
250
200
150
100
50
0
damage
Damage (MeV-barns)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

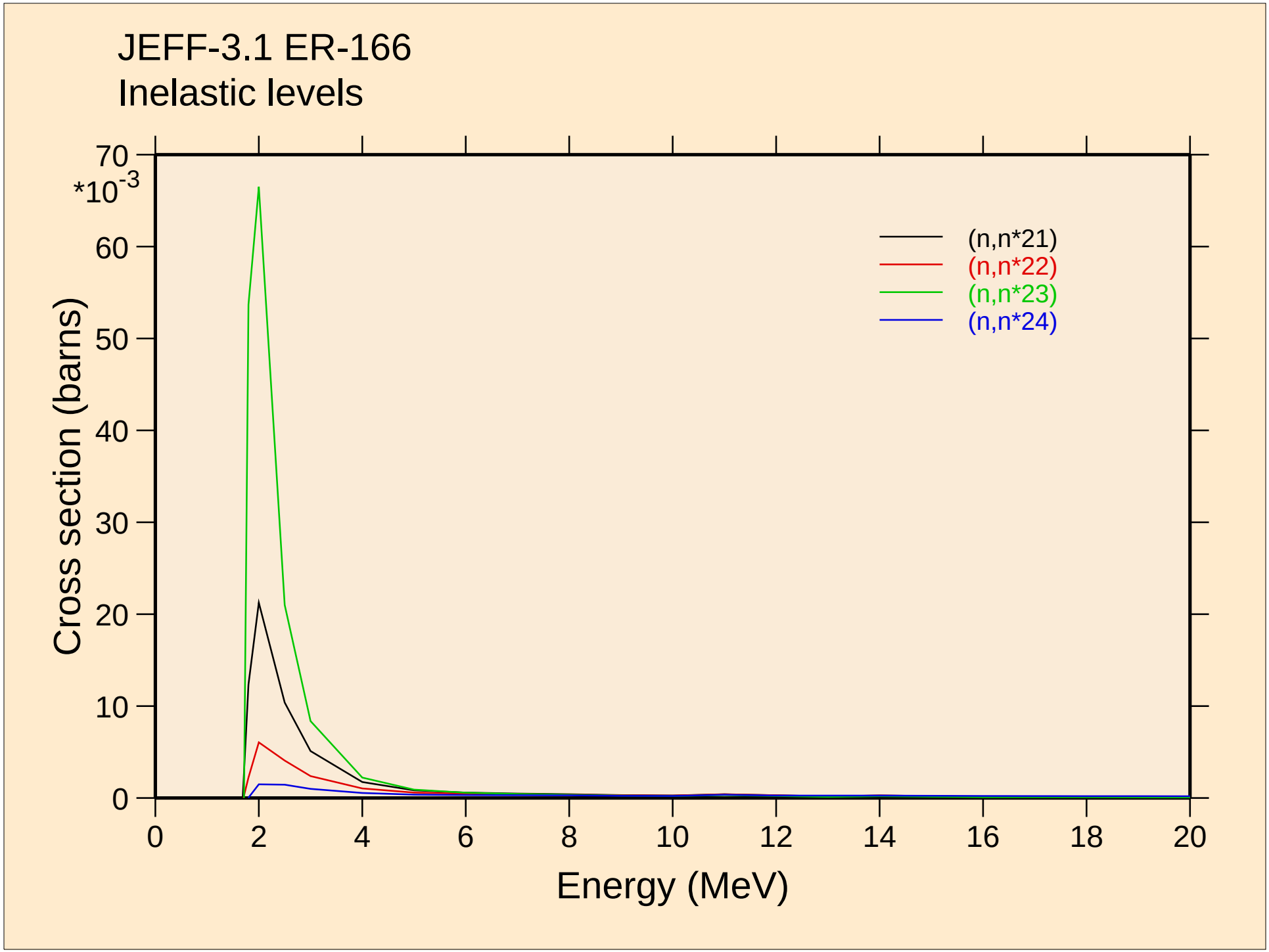

JEFF-3.1 ER-166
Non-threshold reactions
(n,gma)
Cross section (barns)
10-1
10-2
10-3
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

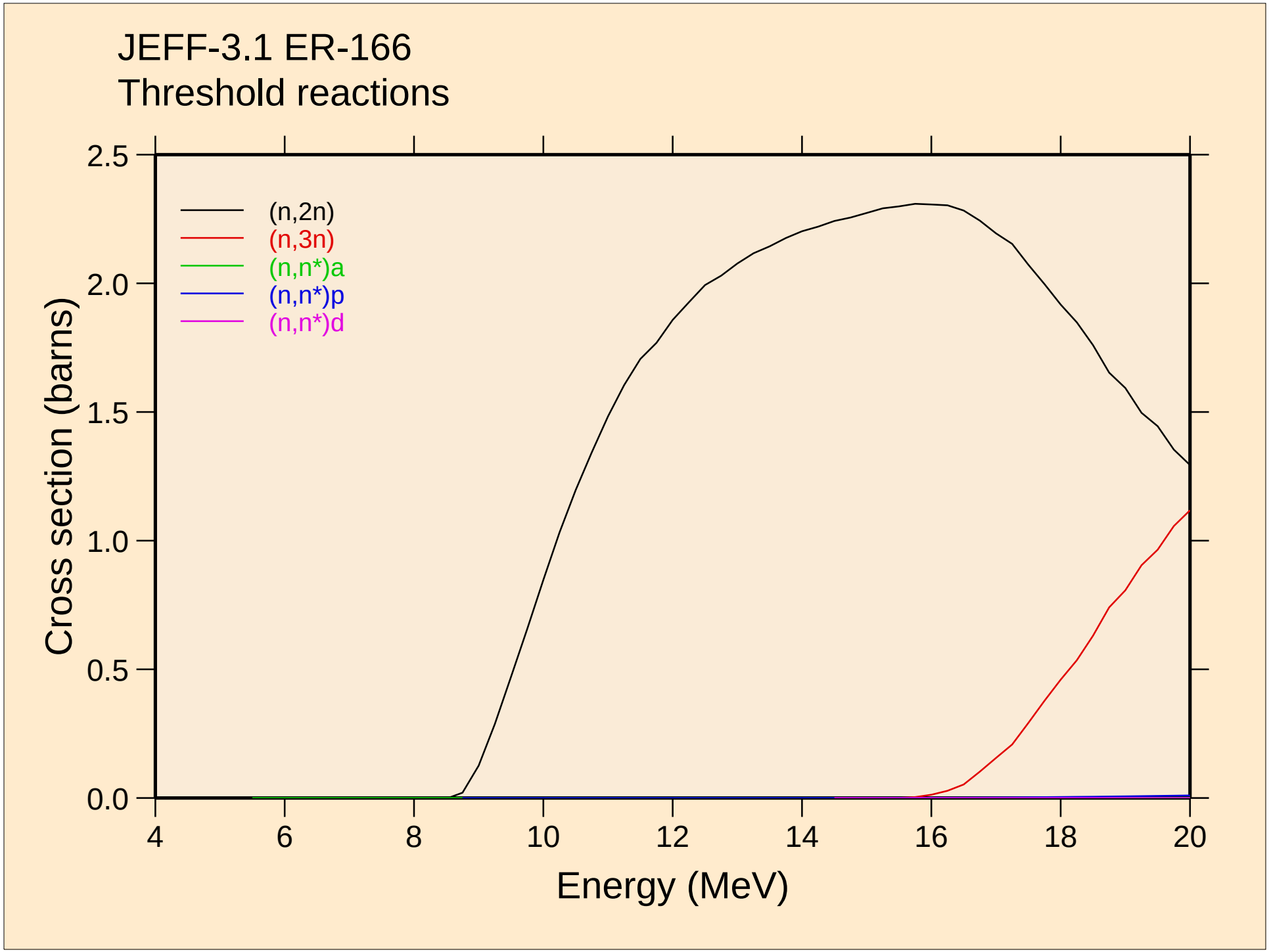

JEFF-3.1 ER-166
Inelastic levels
Cross section (barns)
Energy (MeV)
(n,n*1)
(n,n*2)
(n,n*3)
(n,n*4)
(n,n*5)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
2
4
6
8
10
12
14
16
18
20

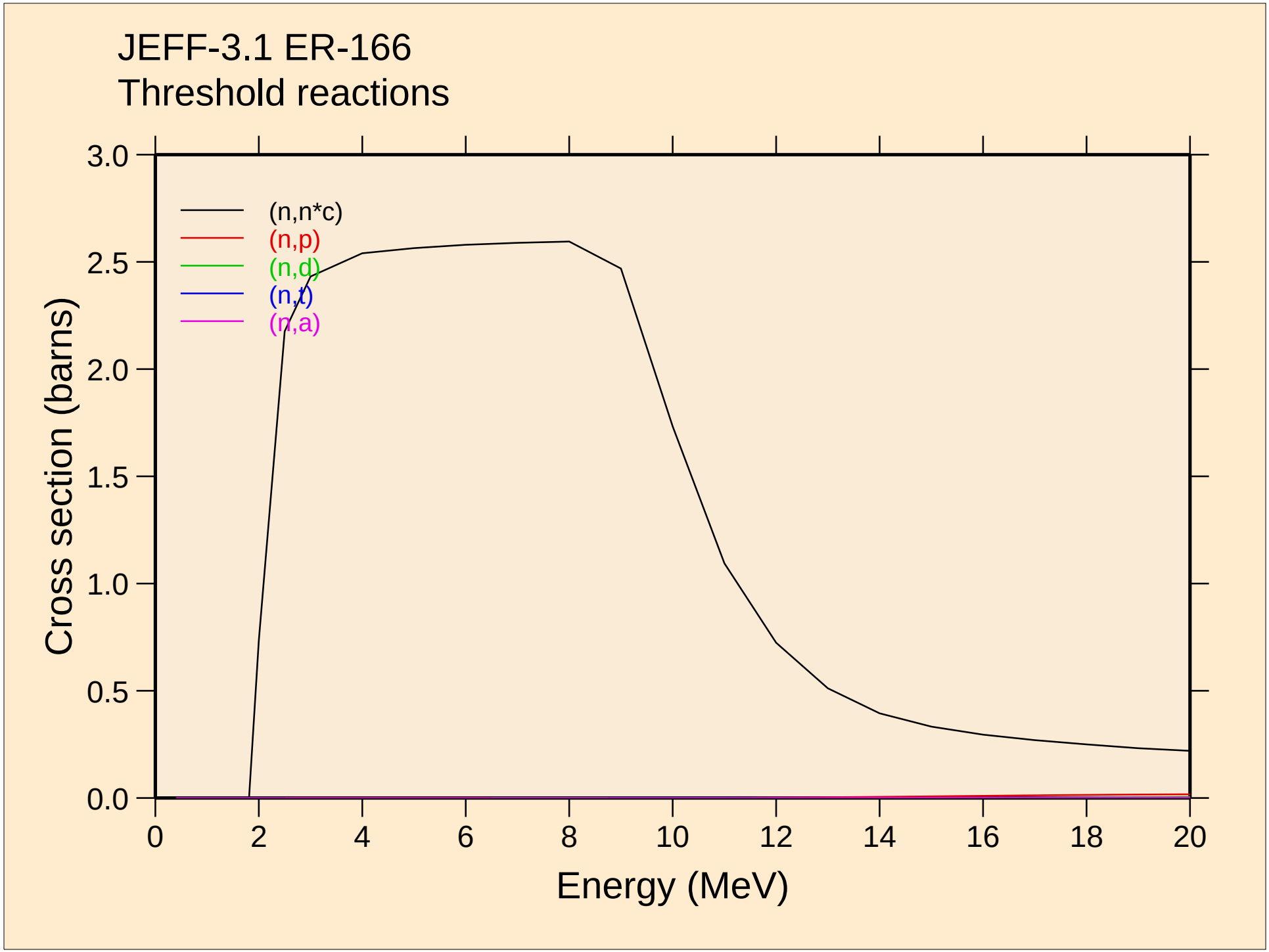

JEFF-3.1 ER-166
Inelastic levels
Cross section (barns)
*10-3
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*6)
(n,n*7)
(n,n*8)
(n,n*9)
(n,n*10)

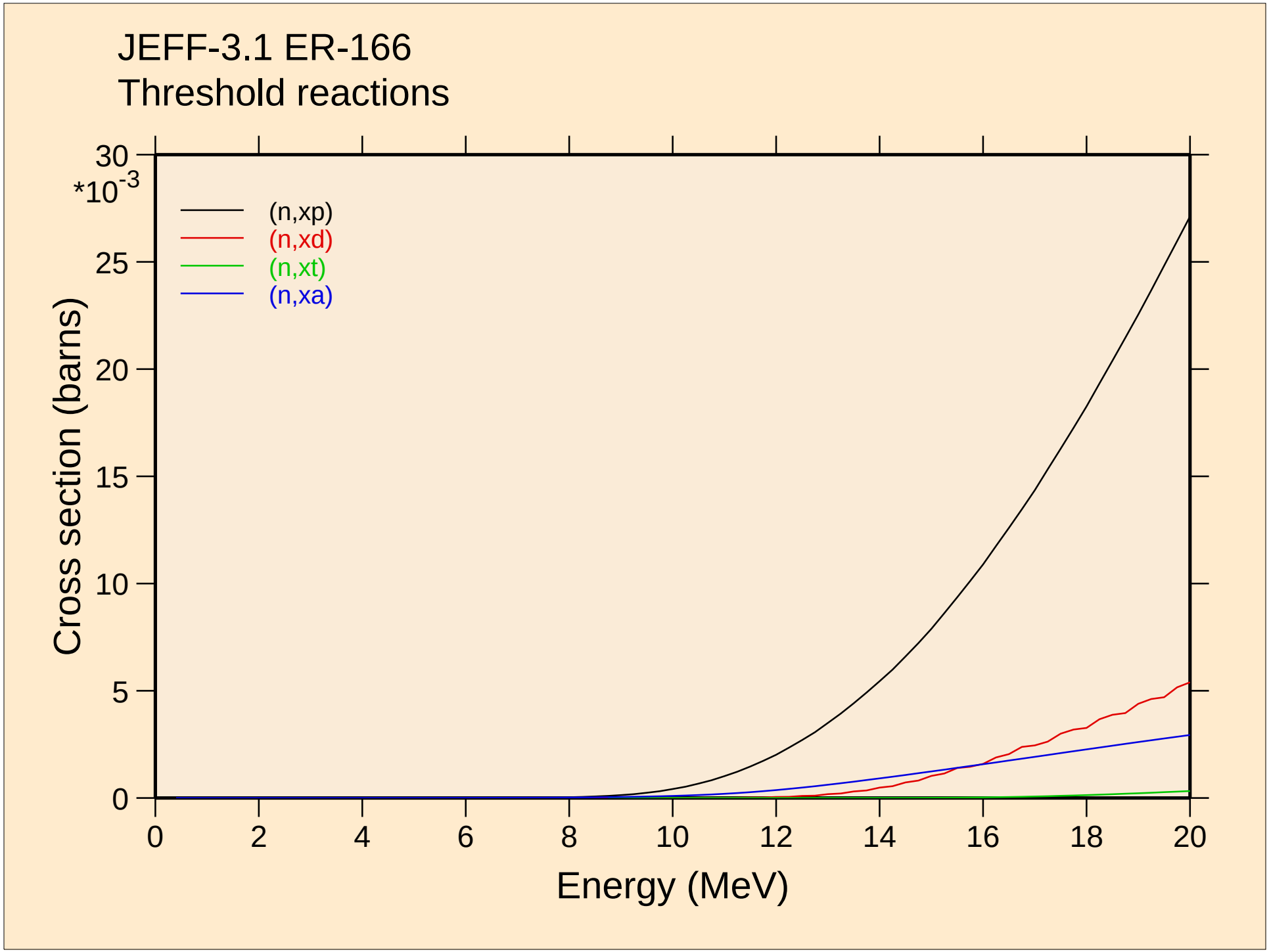

JEFF-3.1 ER-166
Inelastic levels
Cross section (barns)
*10-3
140
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*11)
(n,n*12)
(n,n*13)
(n,n*14)
(n,n*15)

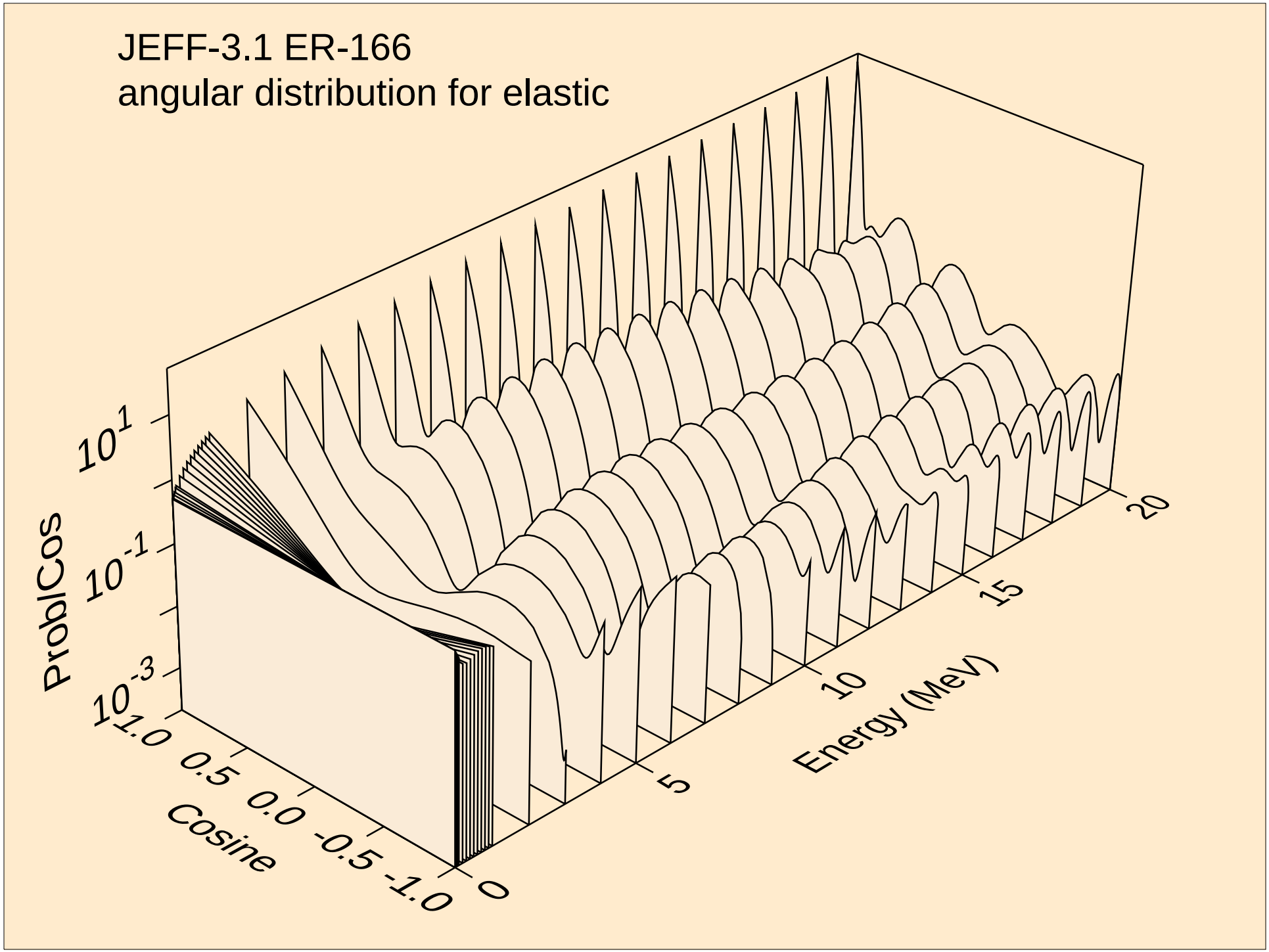

JEFF-3.1 ER-166
Inelastic levels
Cross section (barns)
*10-3
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*16)
(n,n*17)
(n,n*18)
(n,n*19)
(n,n*20)

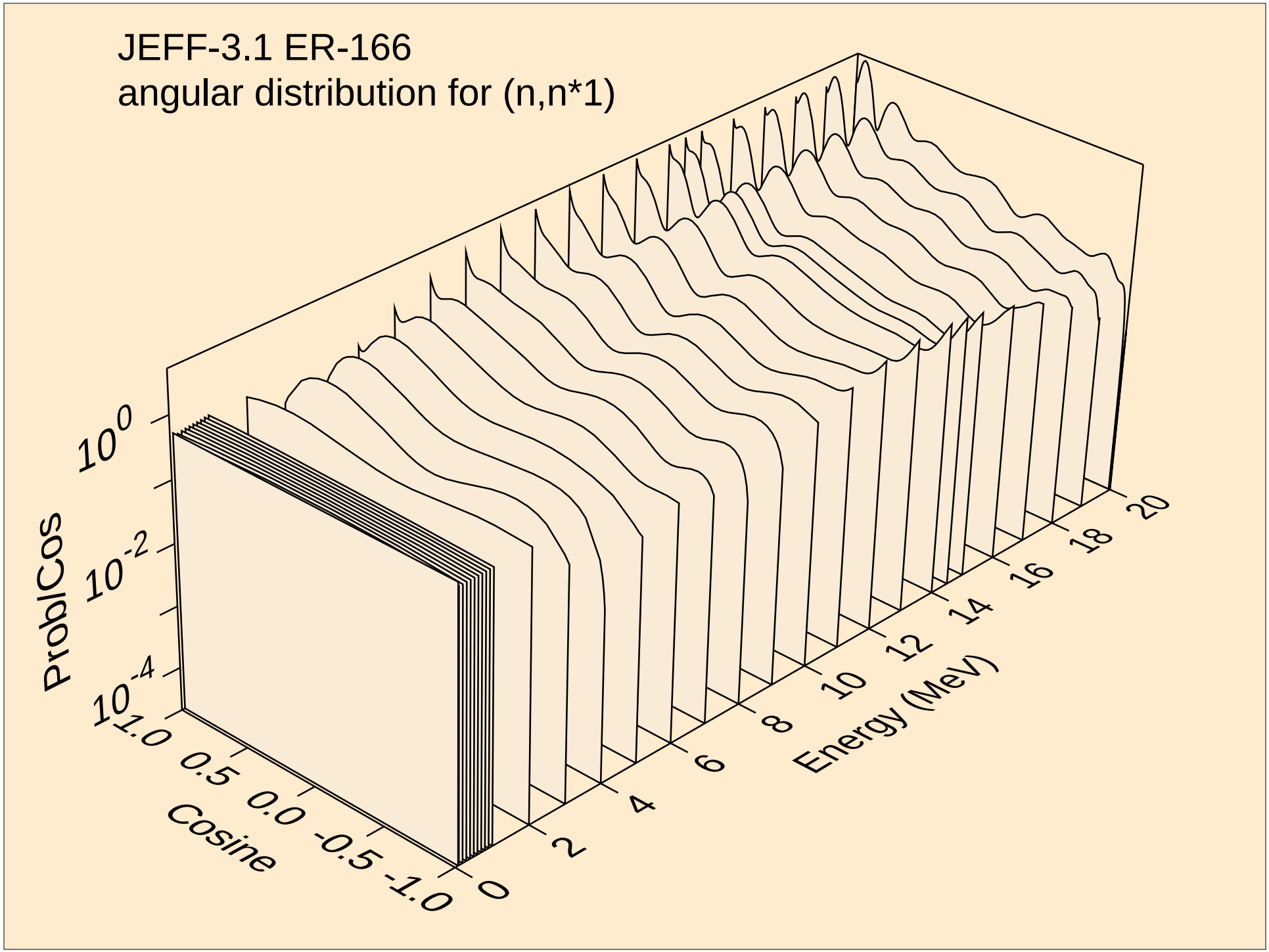

JEFF-3.1 ER-166
Inelastic levels
Cross section (barns)
*10-3
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*21)
(n,n*22)
(n,n*23)
(n,n*24)

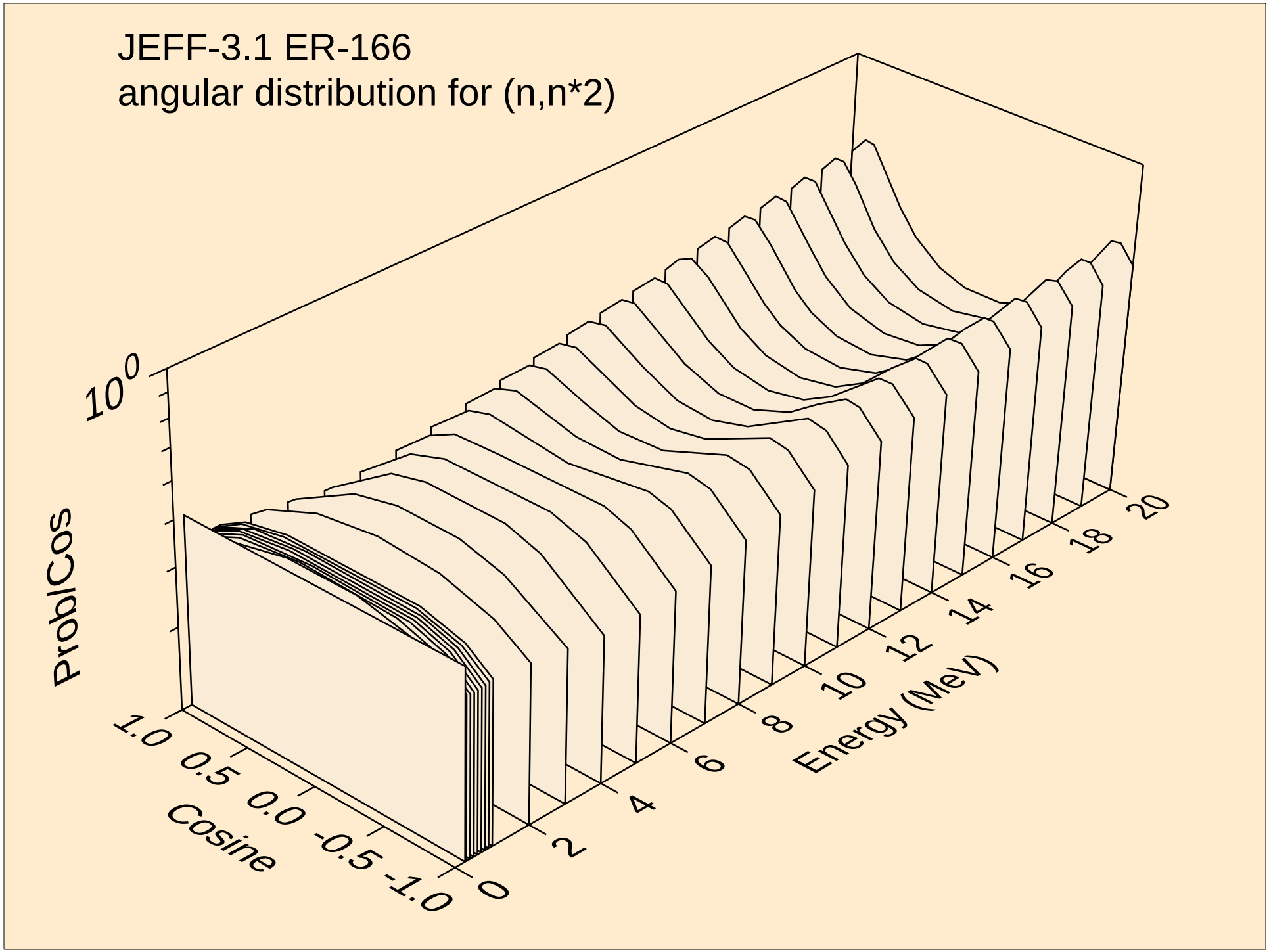

JEFF-3.1 ER-166
Threshold reactions
(n,2n)
(n,3n)
(n,n*)a
(n,n*)p
(n,n*)d
Cross section (barns)
Energy (MeV)
0.0
0.5
1.0
1.5
2.0
2.5
4
6
8
10
12
14
16
18
20

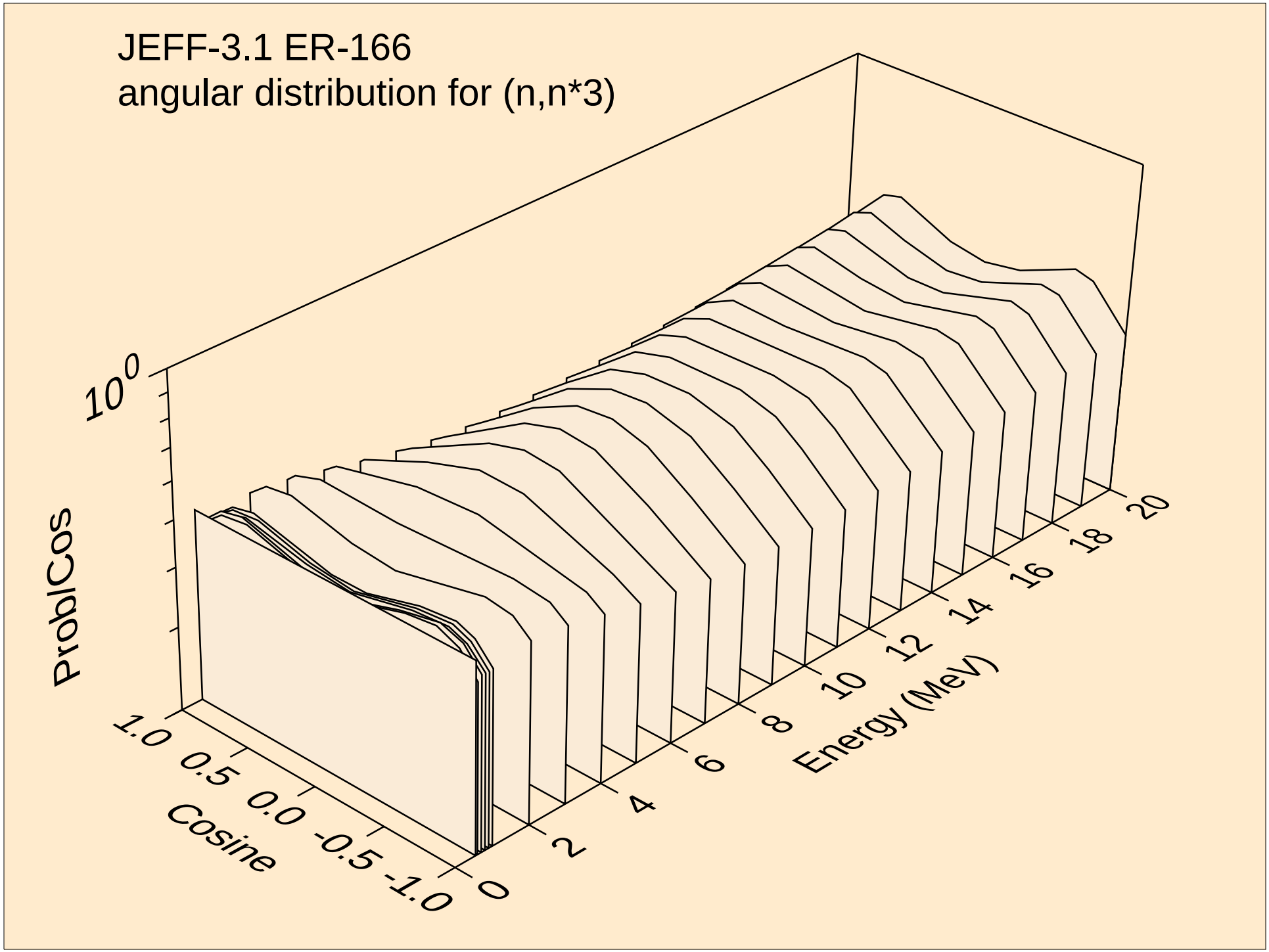

JEFF-3.1 ER-166
Threshold reactions
(n,n*c)
(n,p)
(n,d)
(n,t)
(n,a)
Cross section (barns)
Energy (MeV)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
2
4
6
8
10
12
14
16
18
20

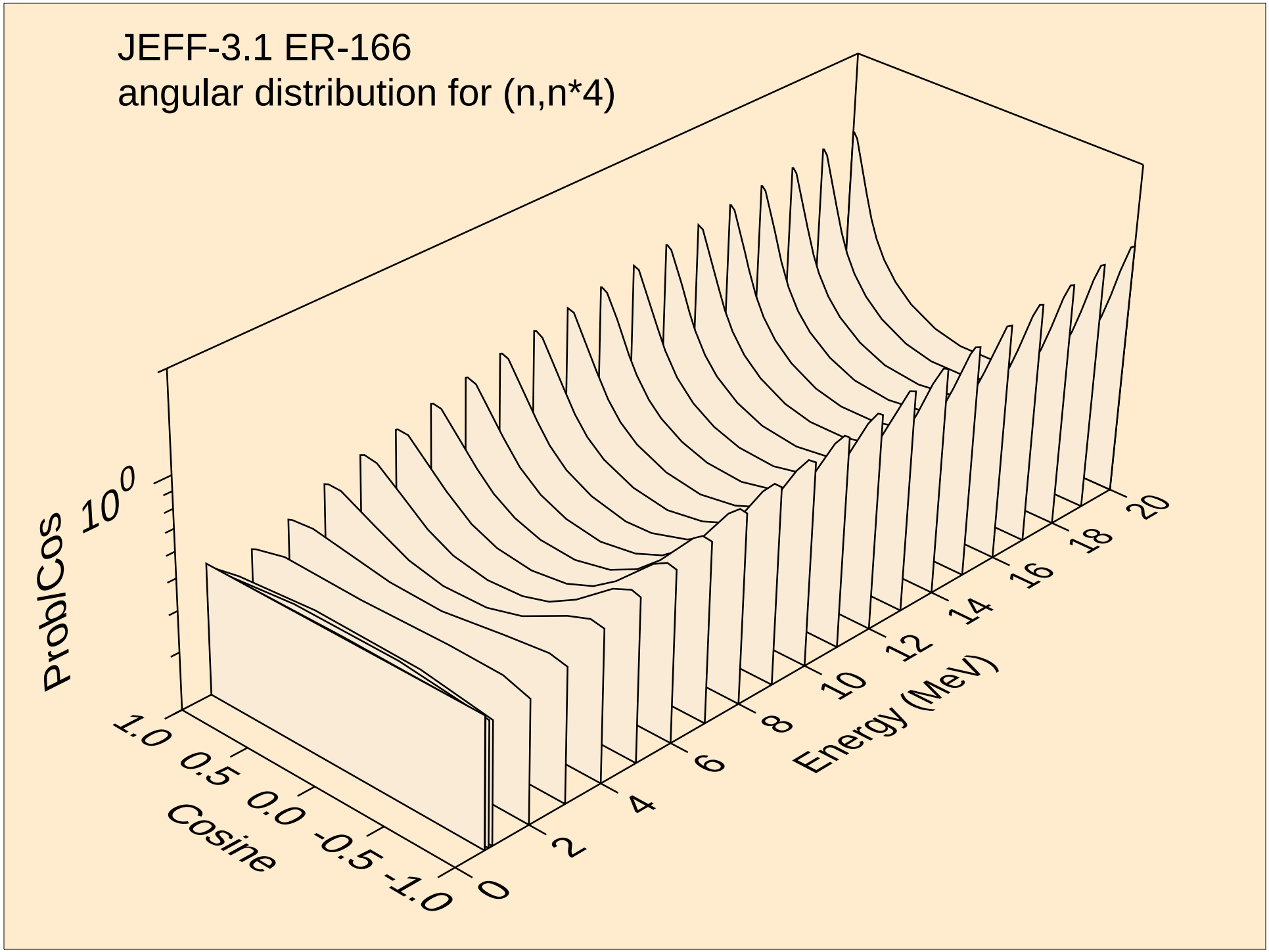

JEFF-3.1 ER-166
Threshold reactions
*10-3
30
25
20
15
10
5
0
Cross section (barns)
(n,xp)
(n,xd)
(n,xt)
(n,xa)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

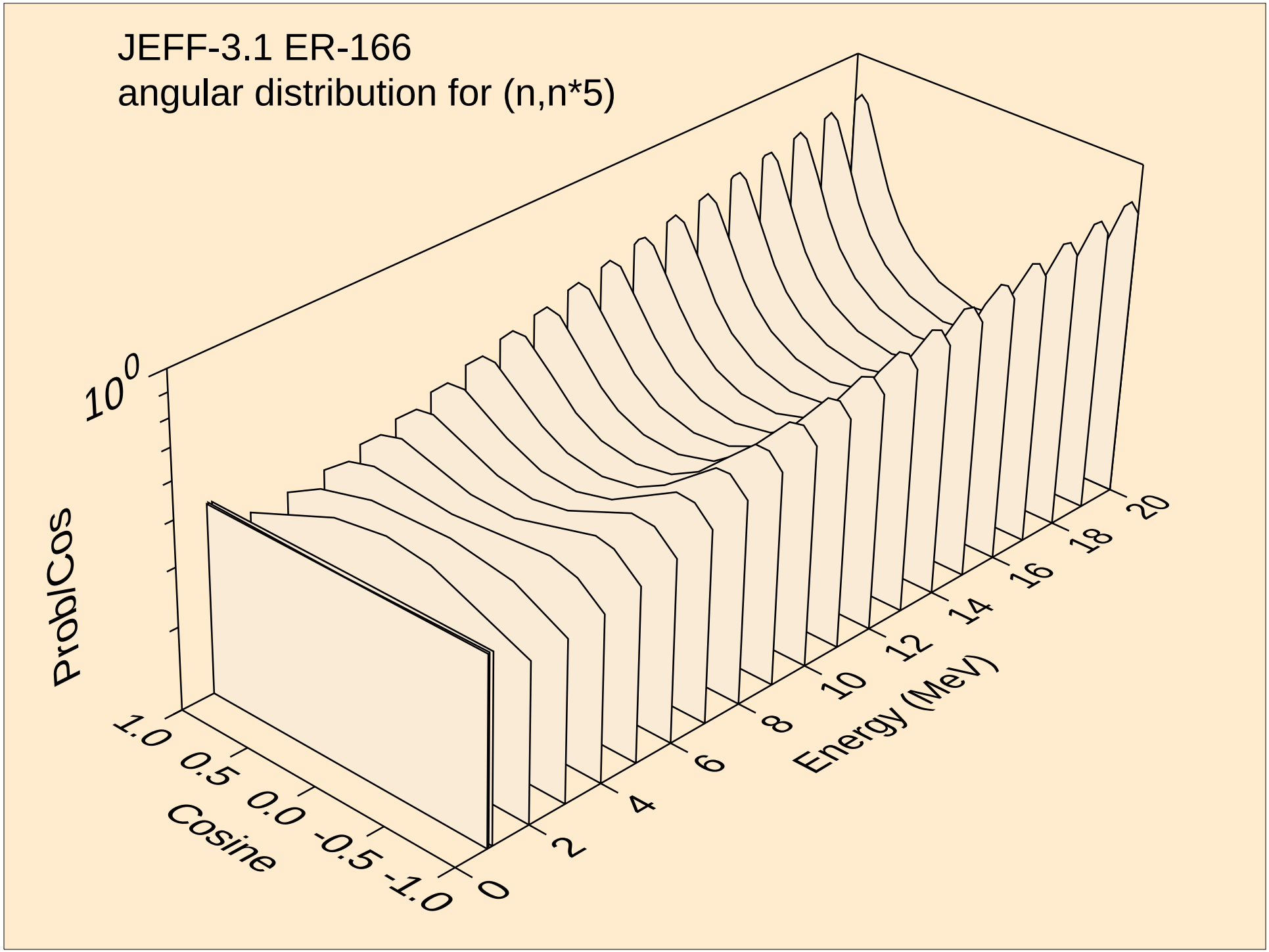

JEFF-3.1 ER-166
angular distribution for elastic
ProbCos
10^{1}
10^{-1}
10^{-3}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
5
10
15
20
Energy (MeV)

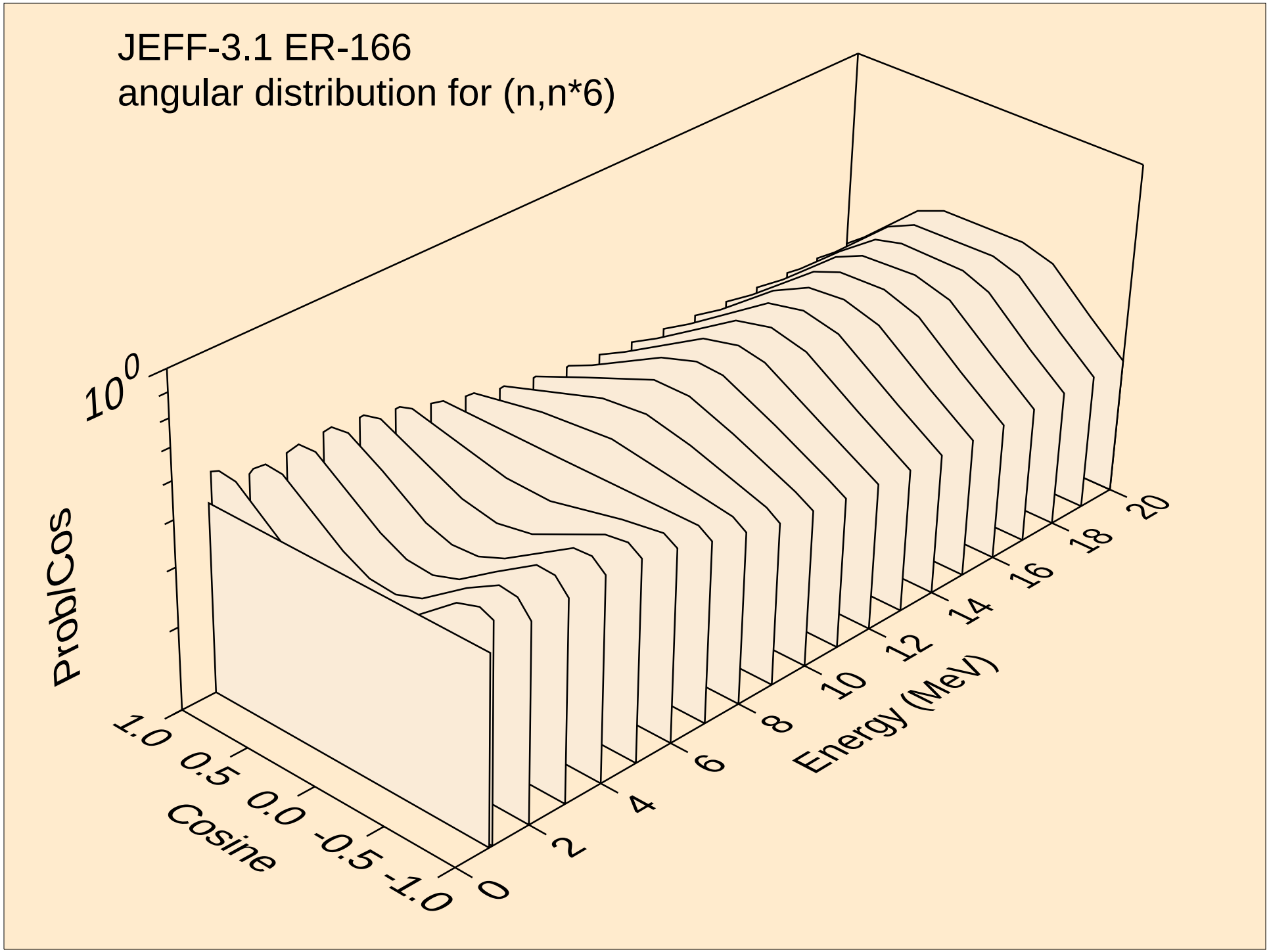

JEFF-3.1 ER-166
angular distribution for (n,n*1)
ProbCos
10^{0}
10^{-2}
10^{-4}
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

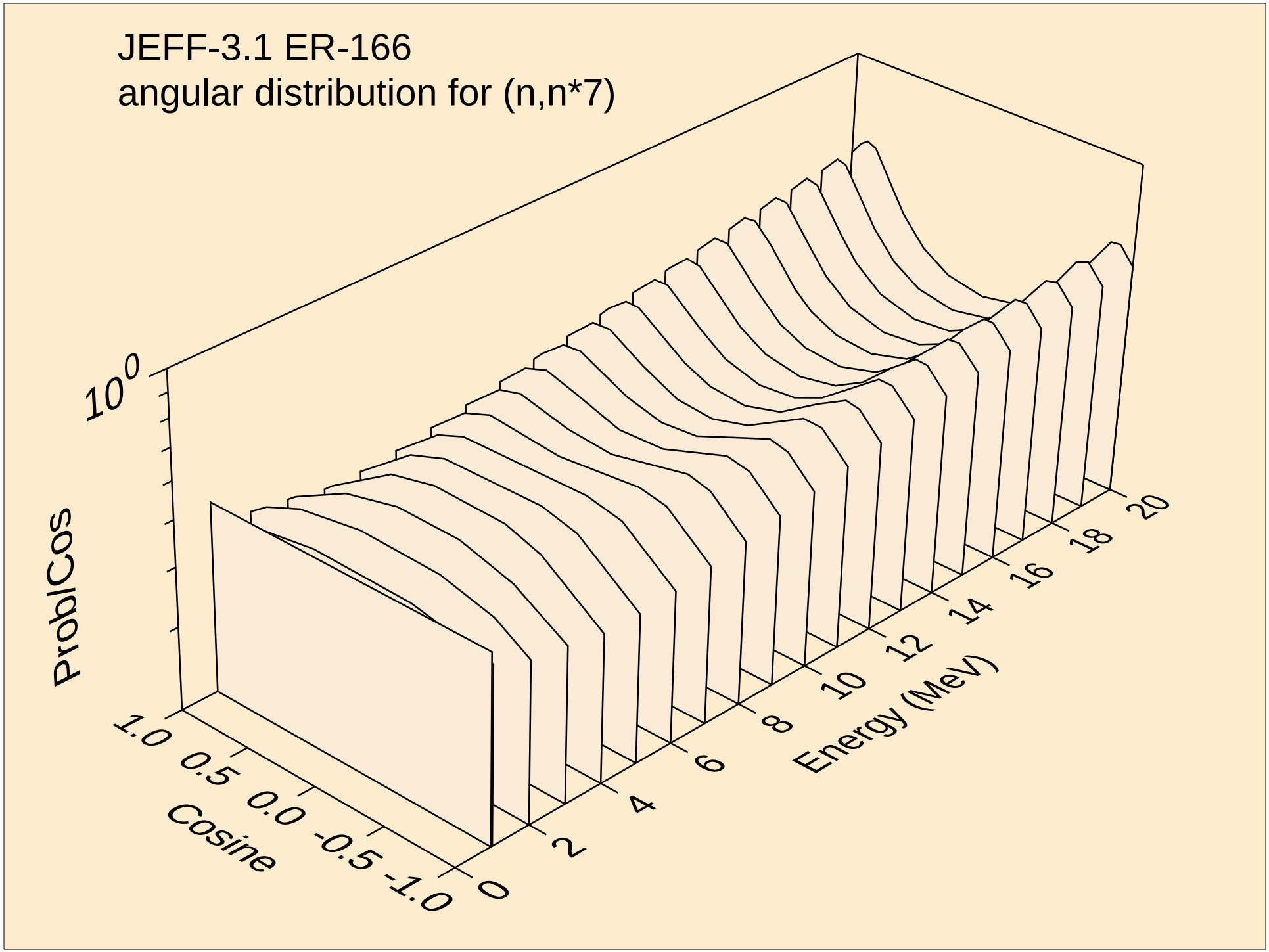

JEFF-3.1 ER-166
angular distribution for (n,n*2)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

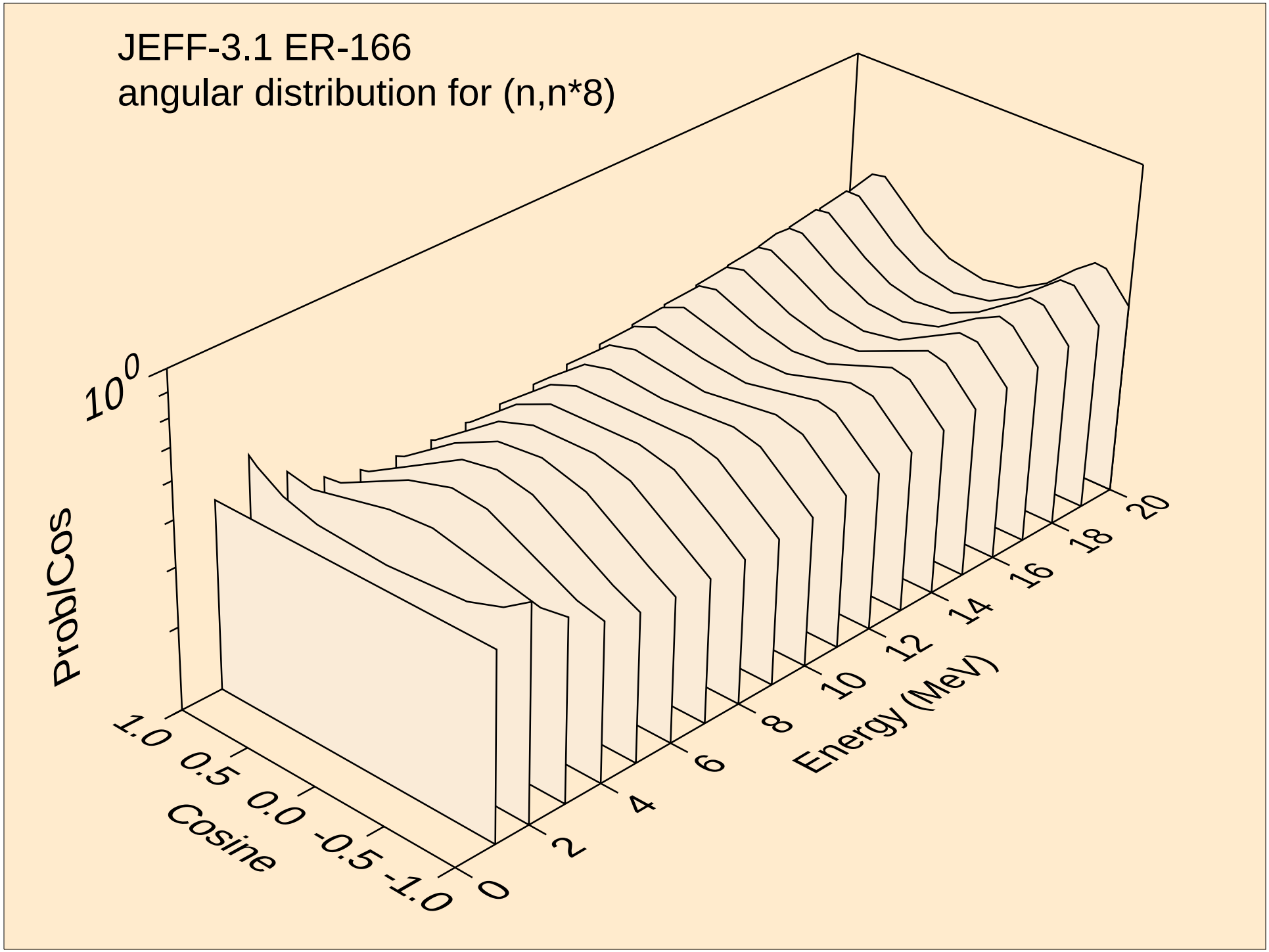

JEFF-3.1 ER-166
angular distribution for (n,n*3)
ProbICos
10^0
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

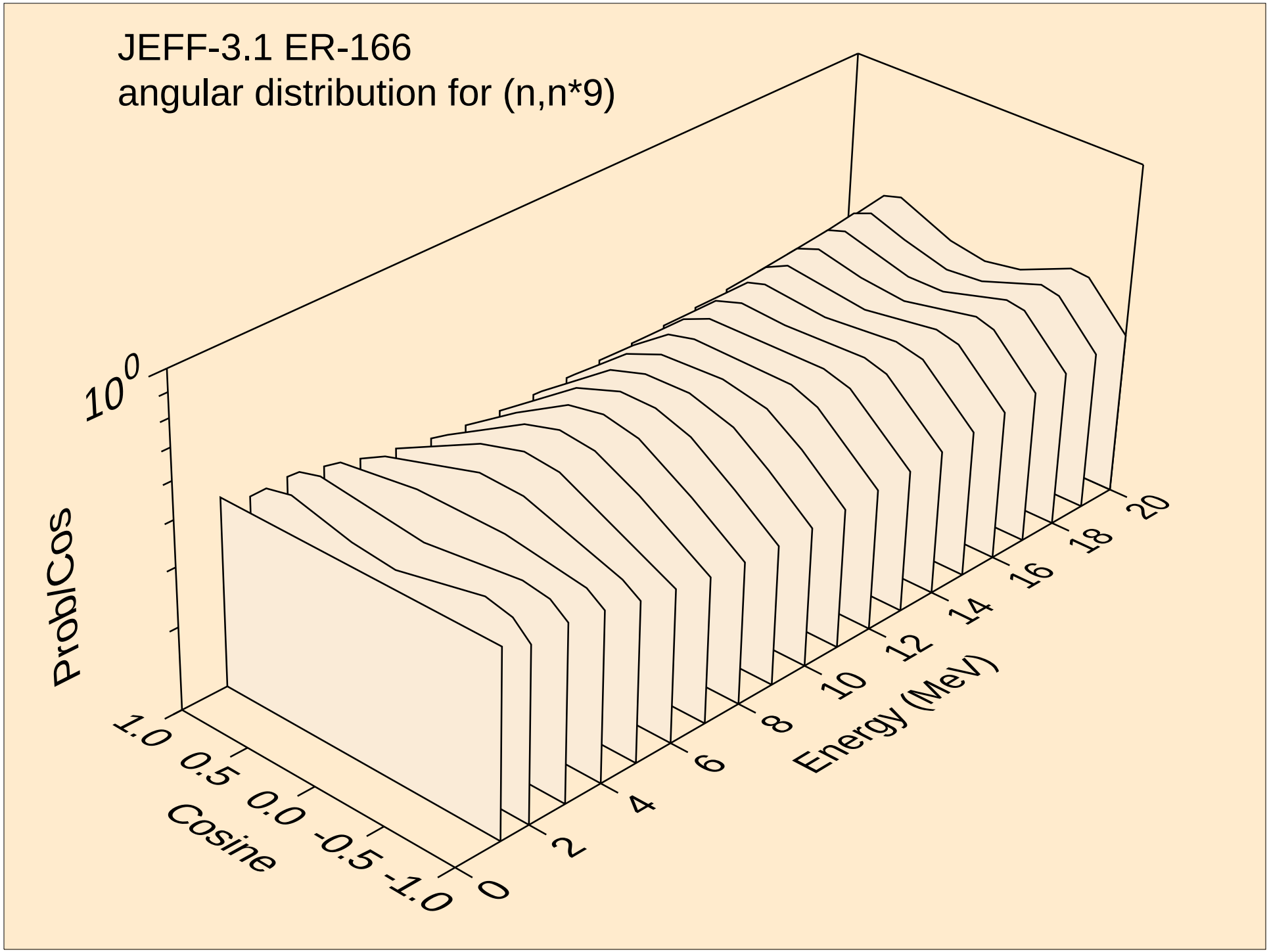

JEFF-3.1 ER-166
angular distribution for (n,n*4)
ProblCos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

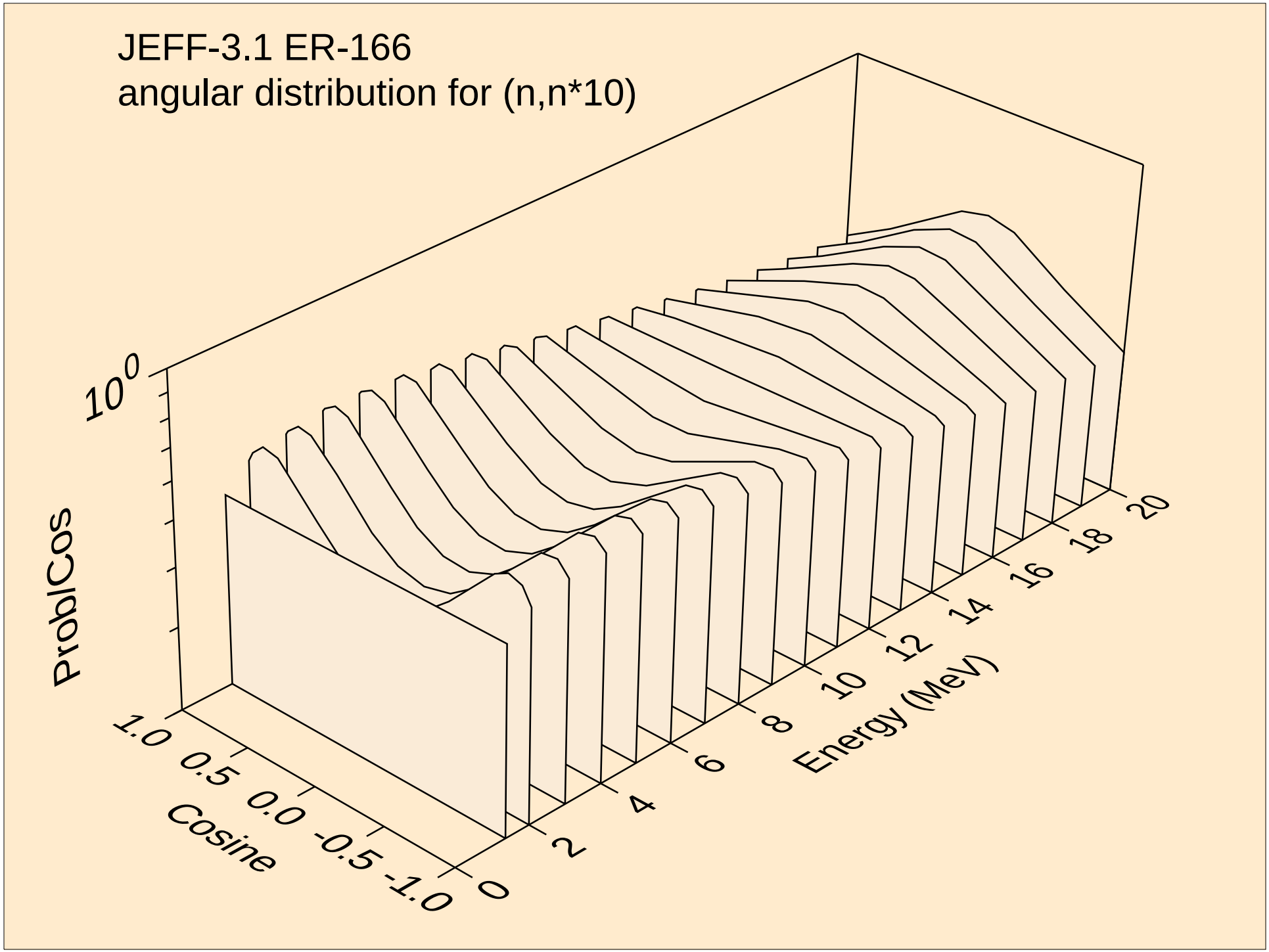

JEFF-3.1 ER-166
angular distribution for (n,n*5)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

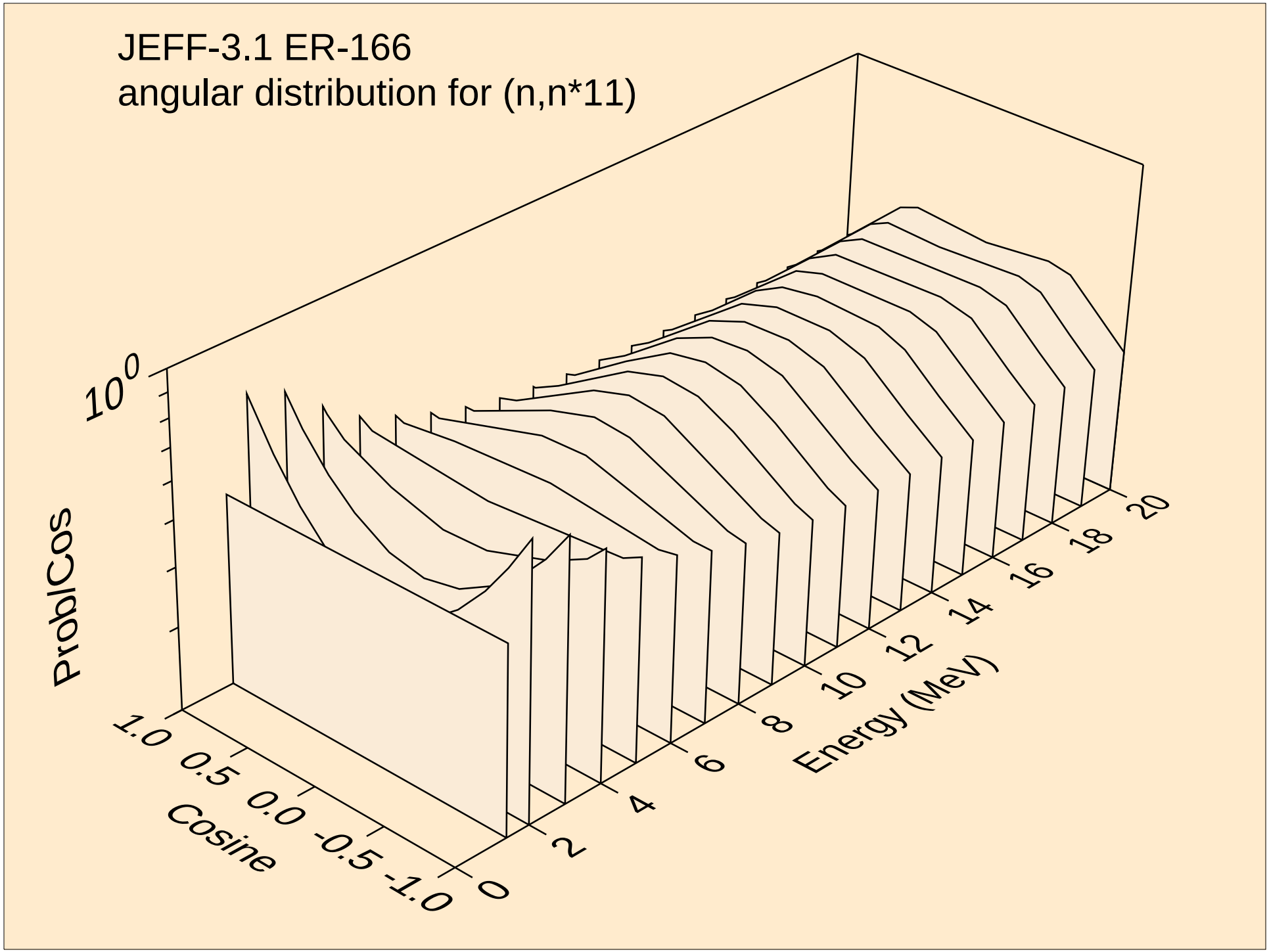

JEFF-3.1 ER-166
angular distribution for (n,n*6)
ProbICos
10^0
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

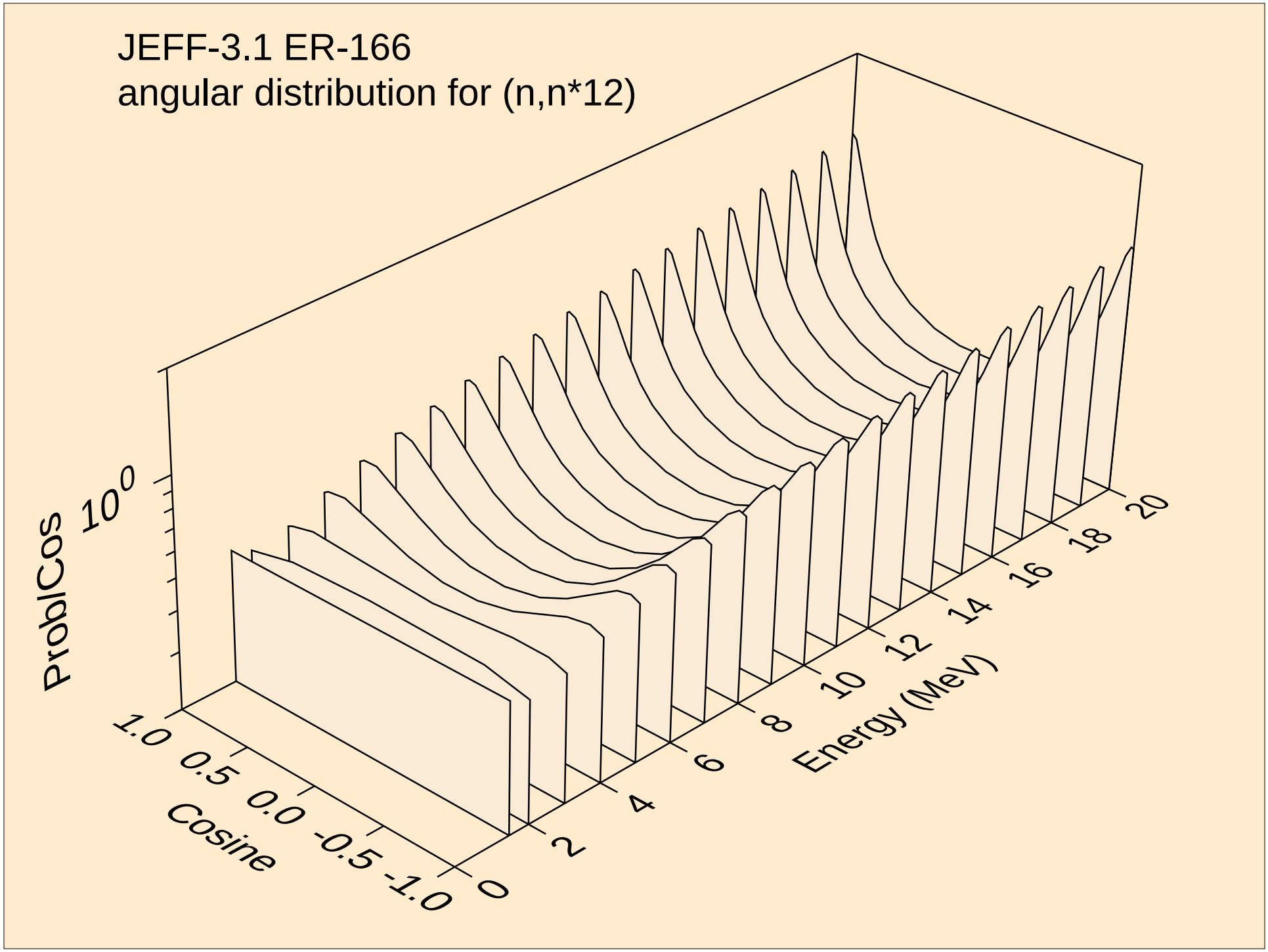

JEFF-3.1 ER-166
angular distribution for (n,n*7)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

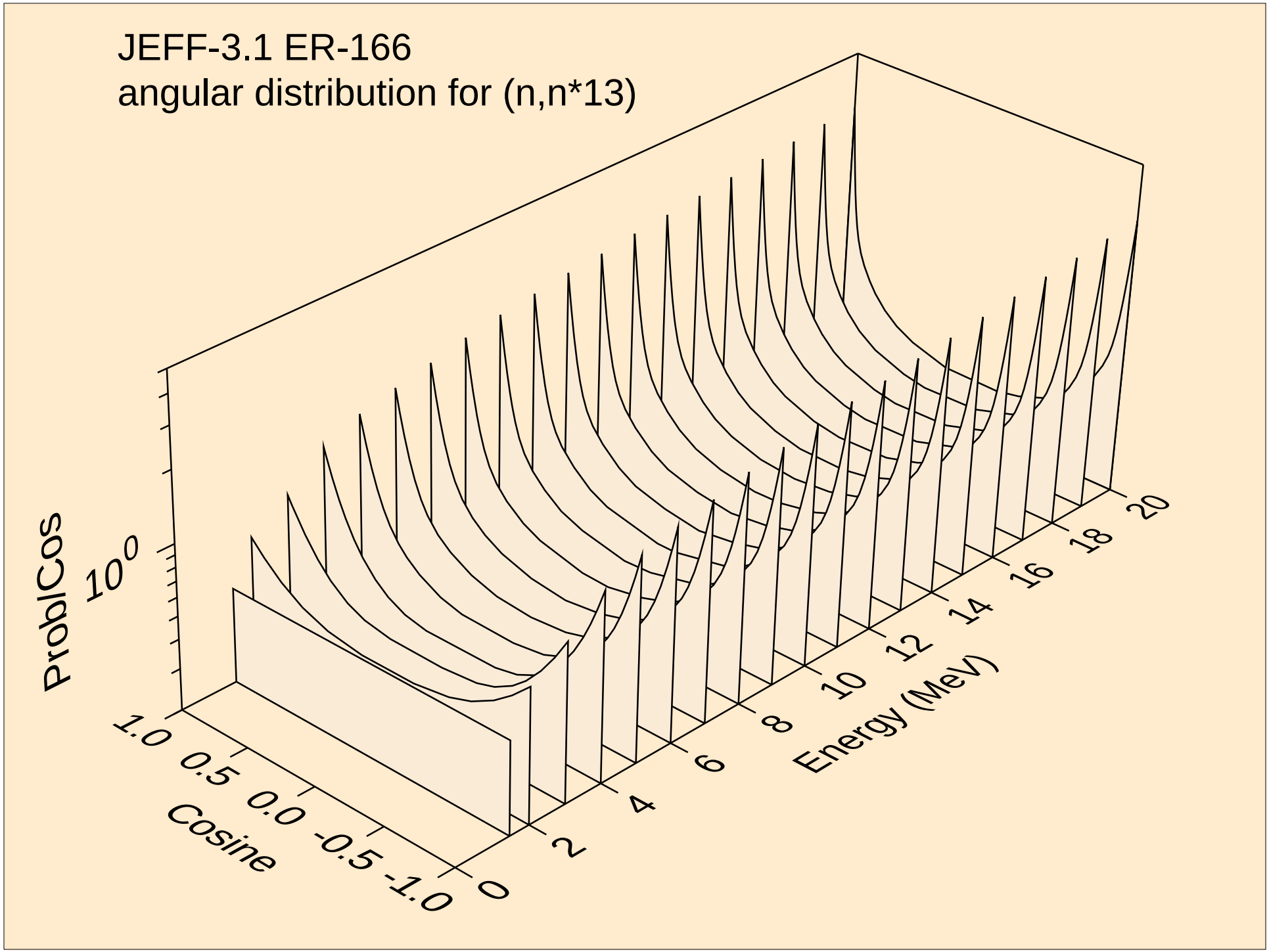

JEFF-3.1 ER-166
angular distribution for (n,n*8)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

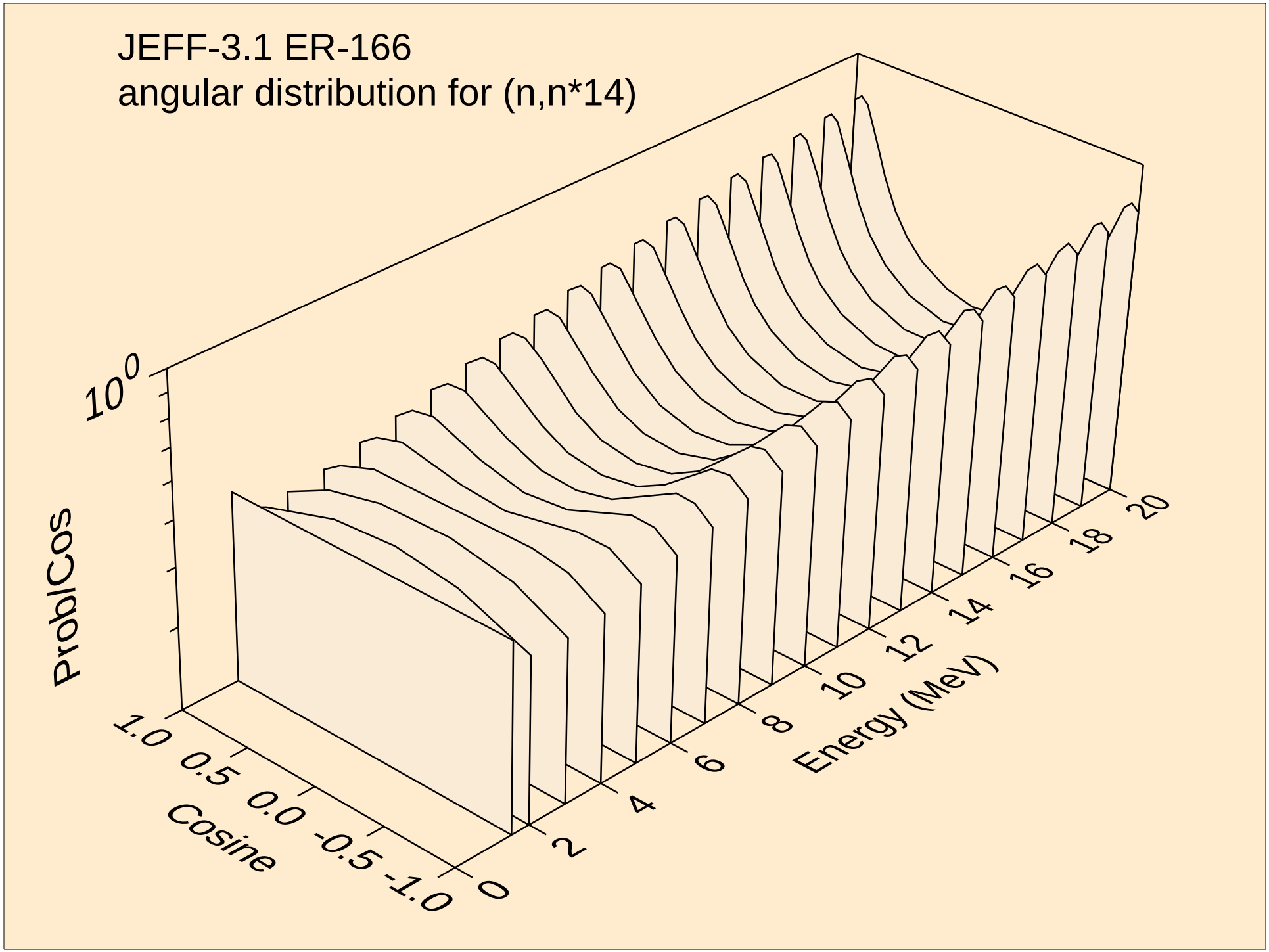

JEFF-3.1 ER-166
angular distribution for (n,n*9)
ProbICos
10^0
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

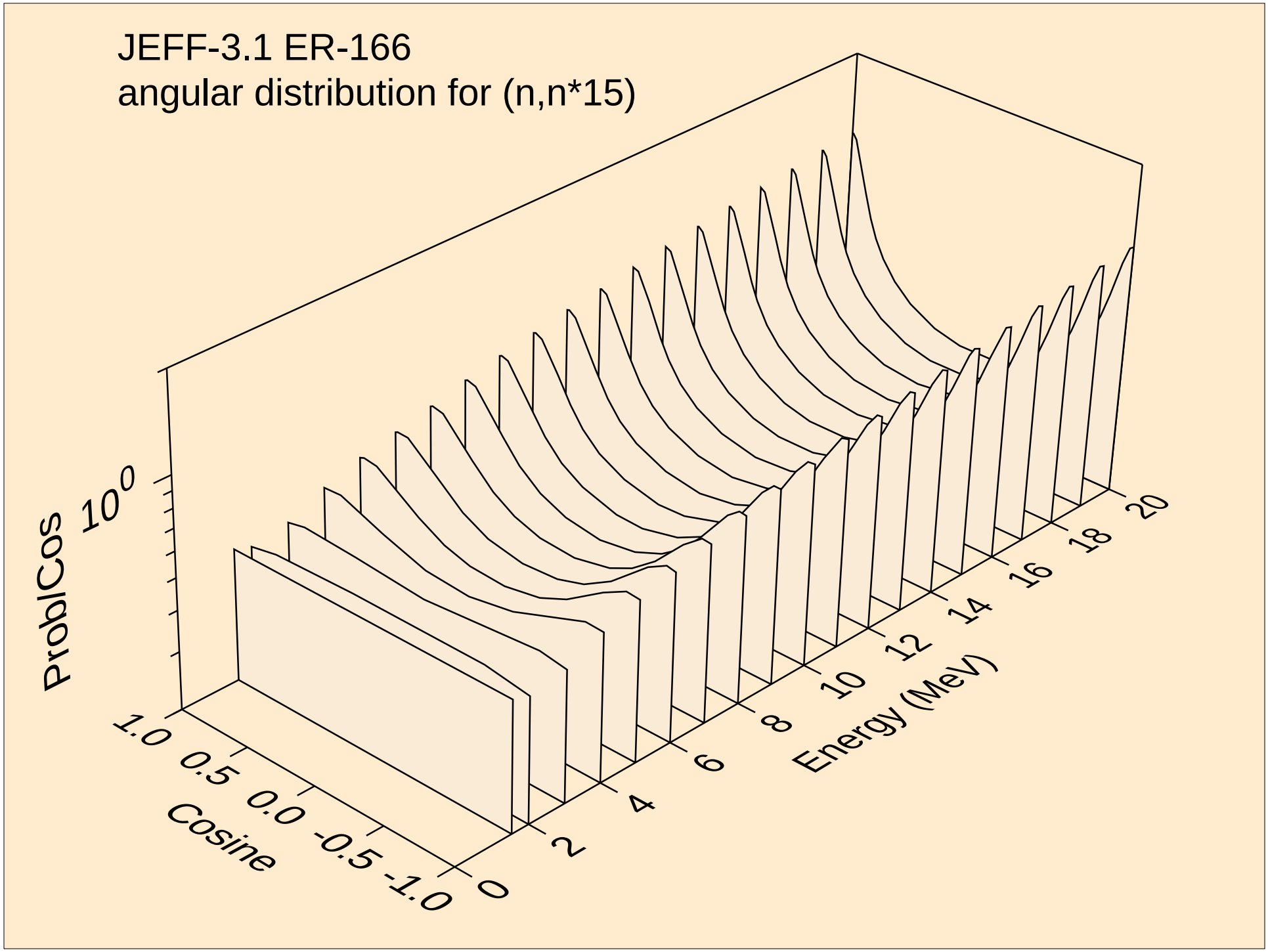

JEFF-3.1 ER-166
angular distribution for (n,n*10)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

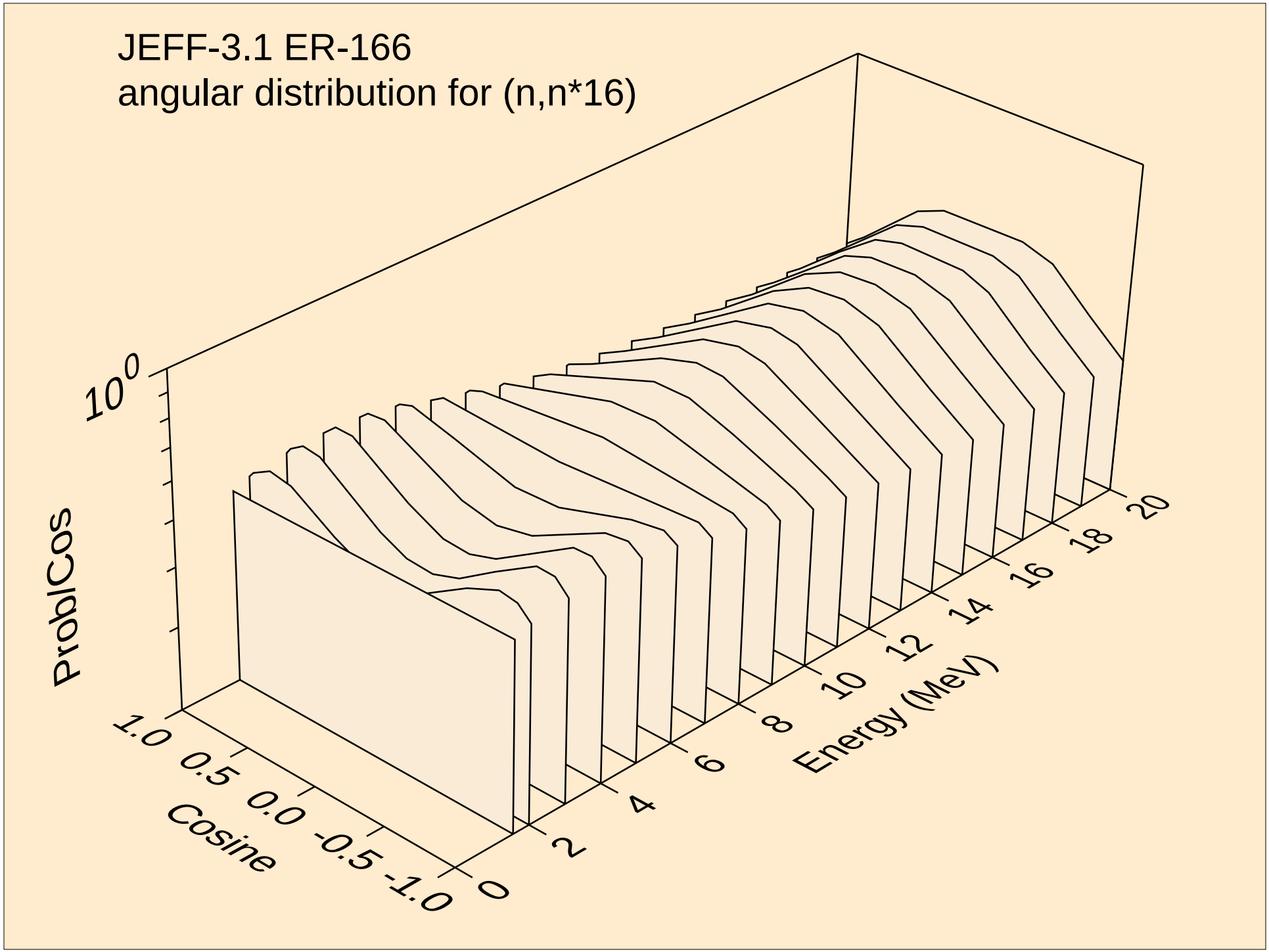

JEFF-3.1 ER-166
angular distribution for (n,n*11)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

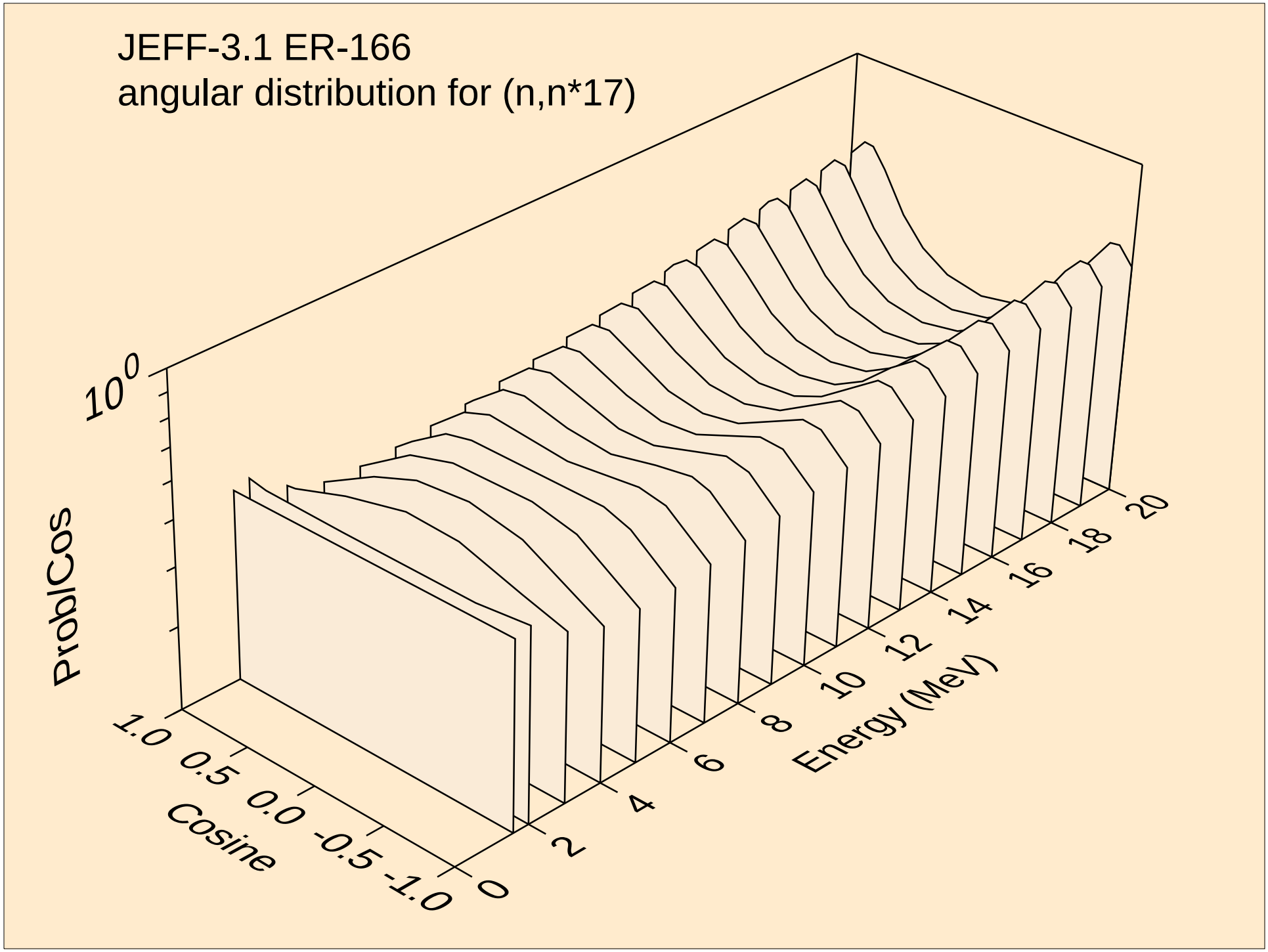

JEFF-3.1 ER-166
angular distribution for (n,n*12)
ProblCos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

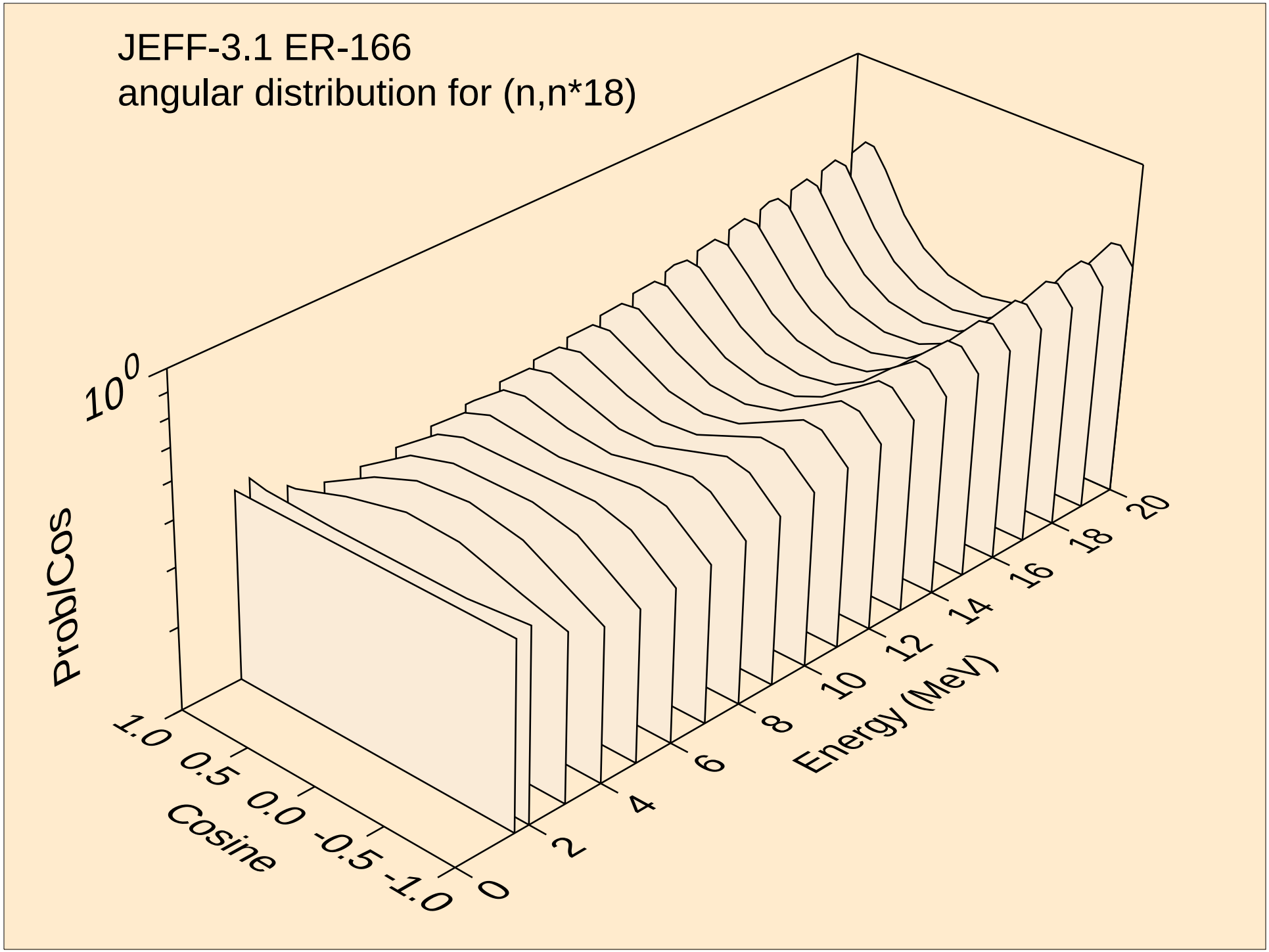

JEFF-3.1 ER-166
angular distribution for (n,n*13)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

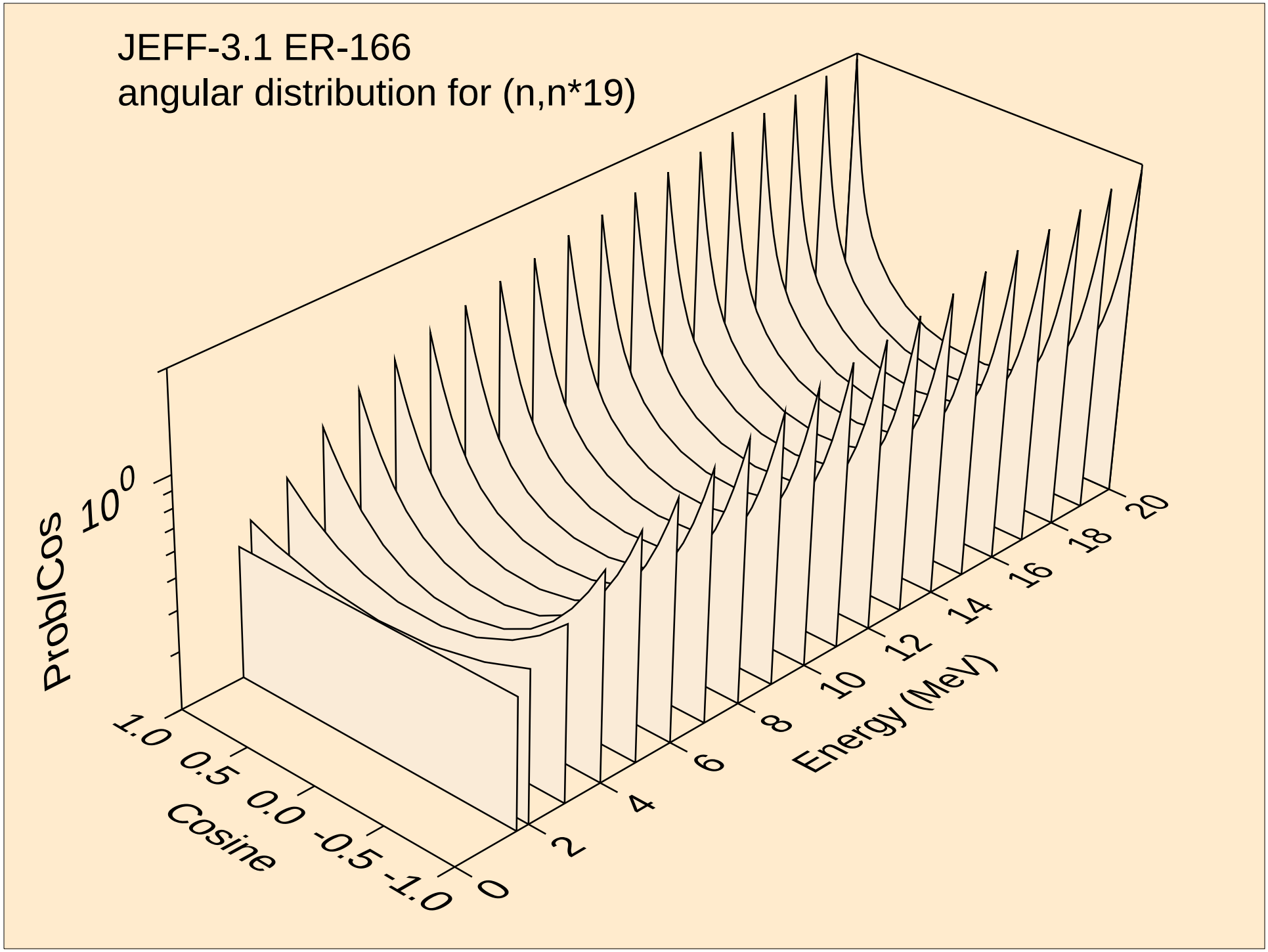

JEFF-3.1 ER-166
angular distribution for (n,n*14)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

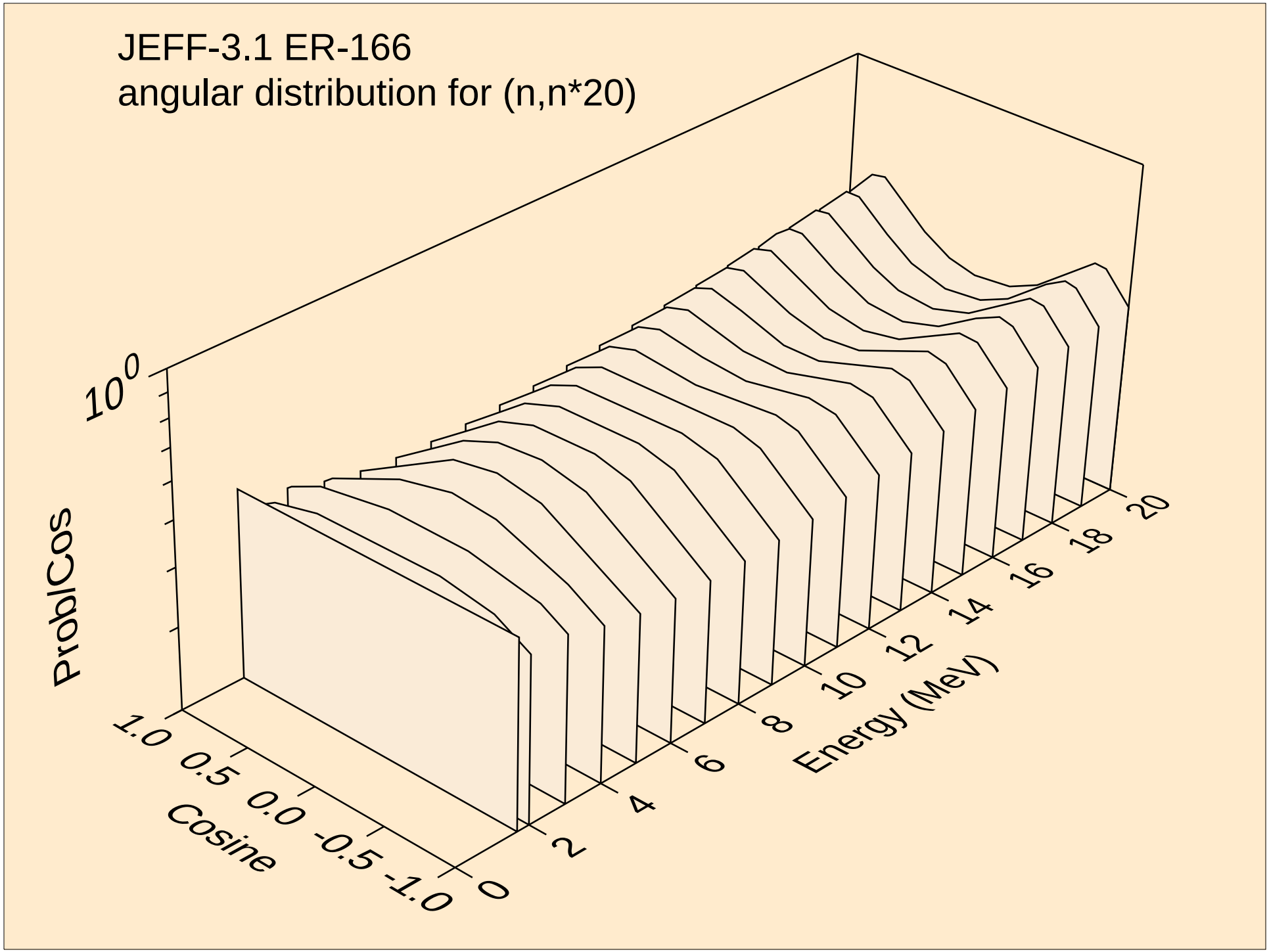

JEFF-3.1 ER-166
angular distribution for (n,n*15)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

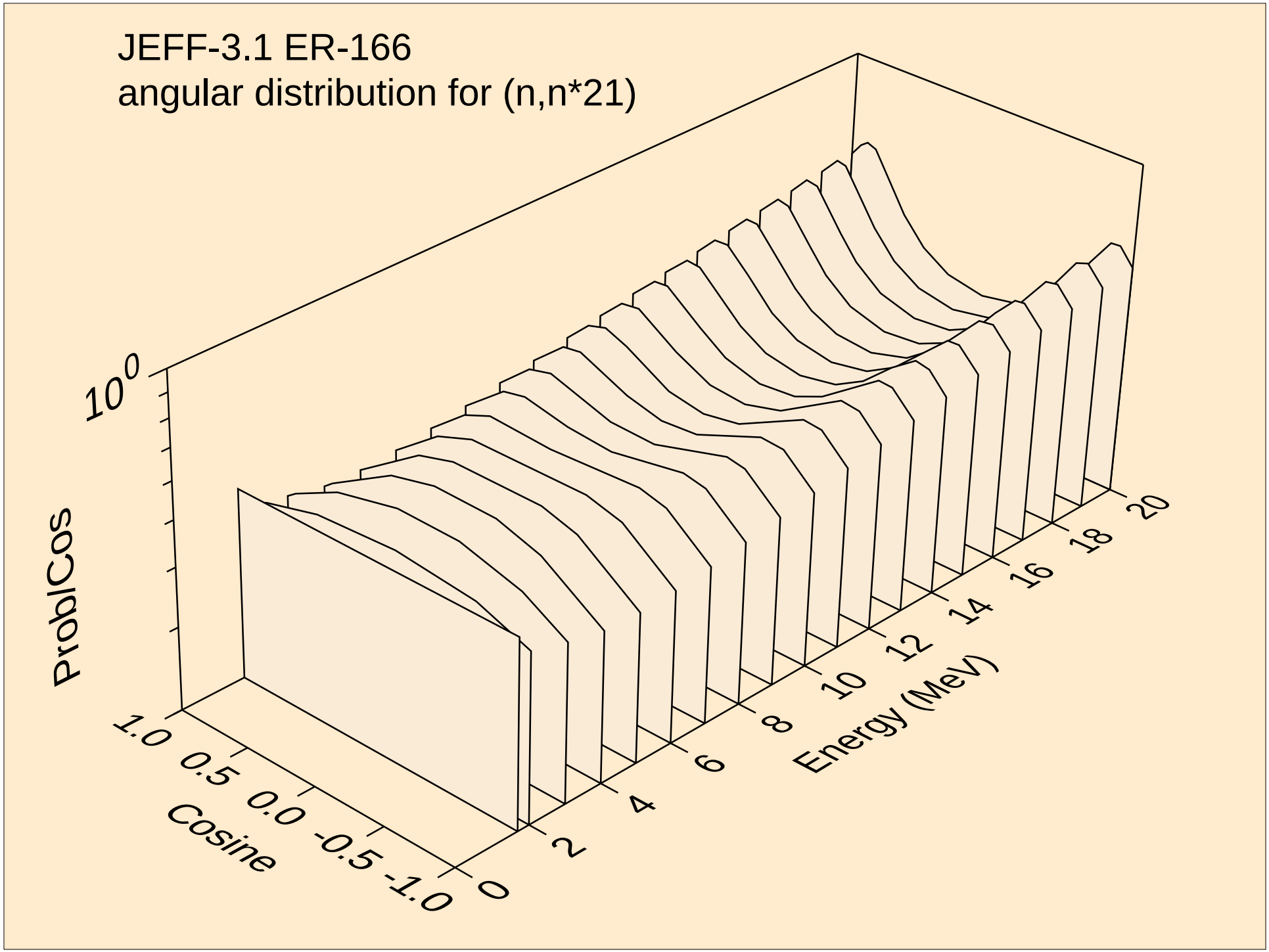

JEFF-3.1 ER-166
angular distribution for (n,n*16)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

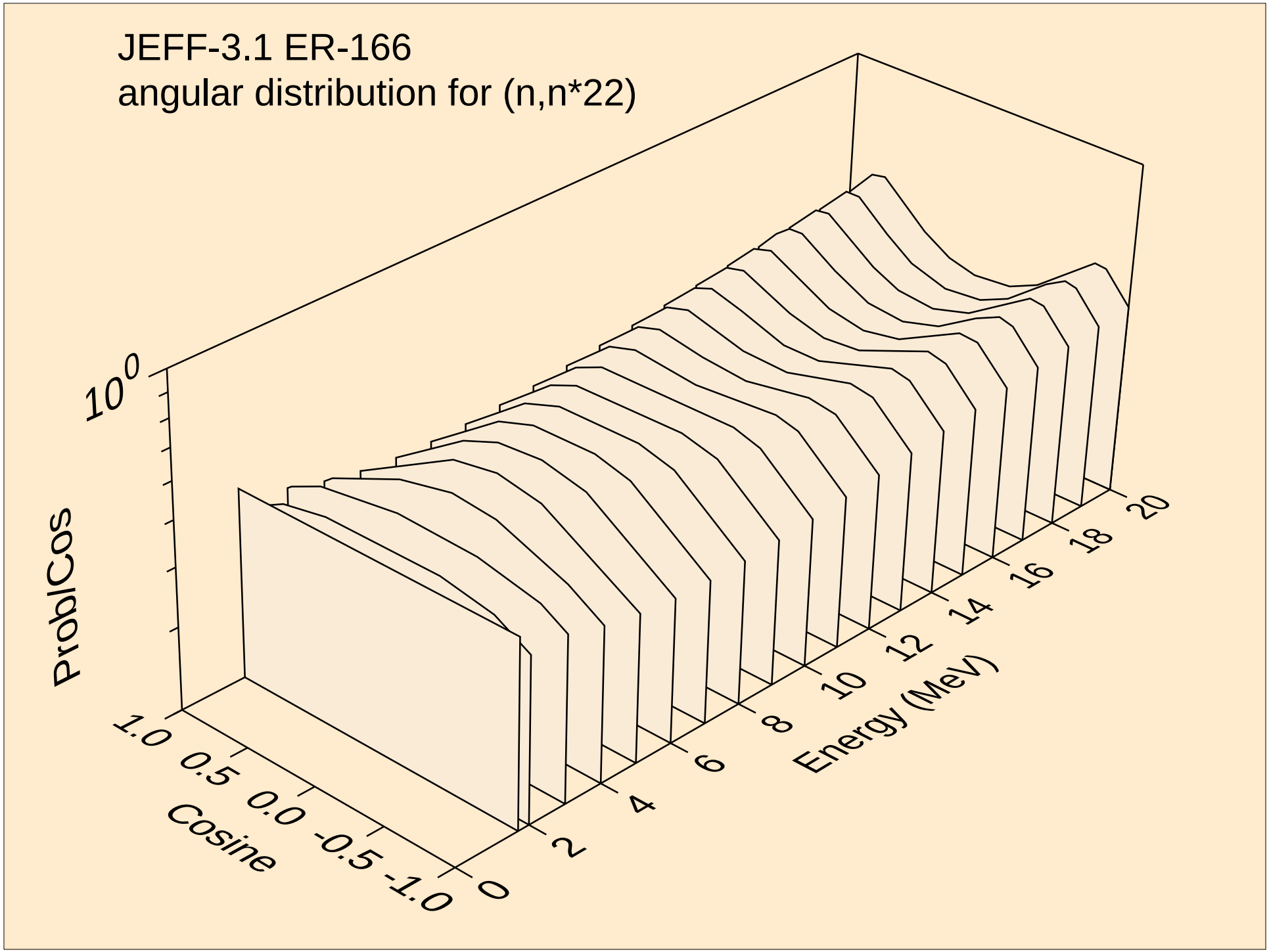

JEFF-3.1 ER-166
angular distribution for (n,n*17)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

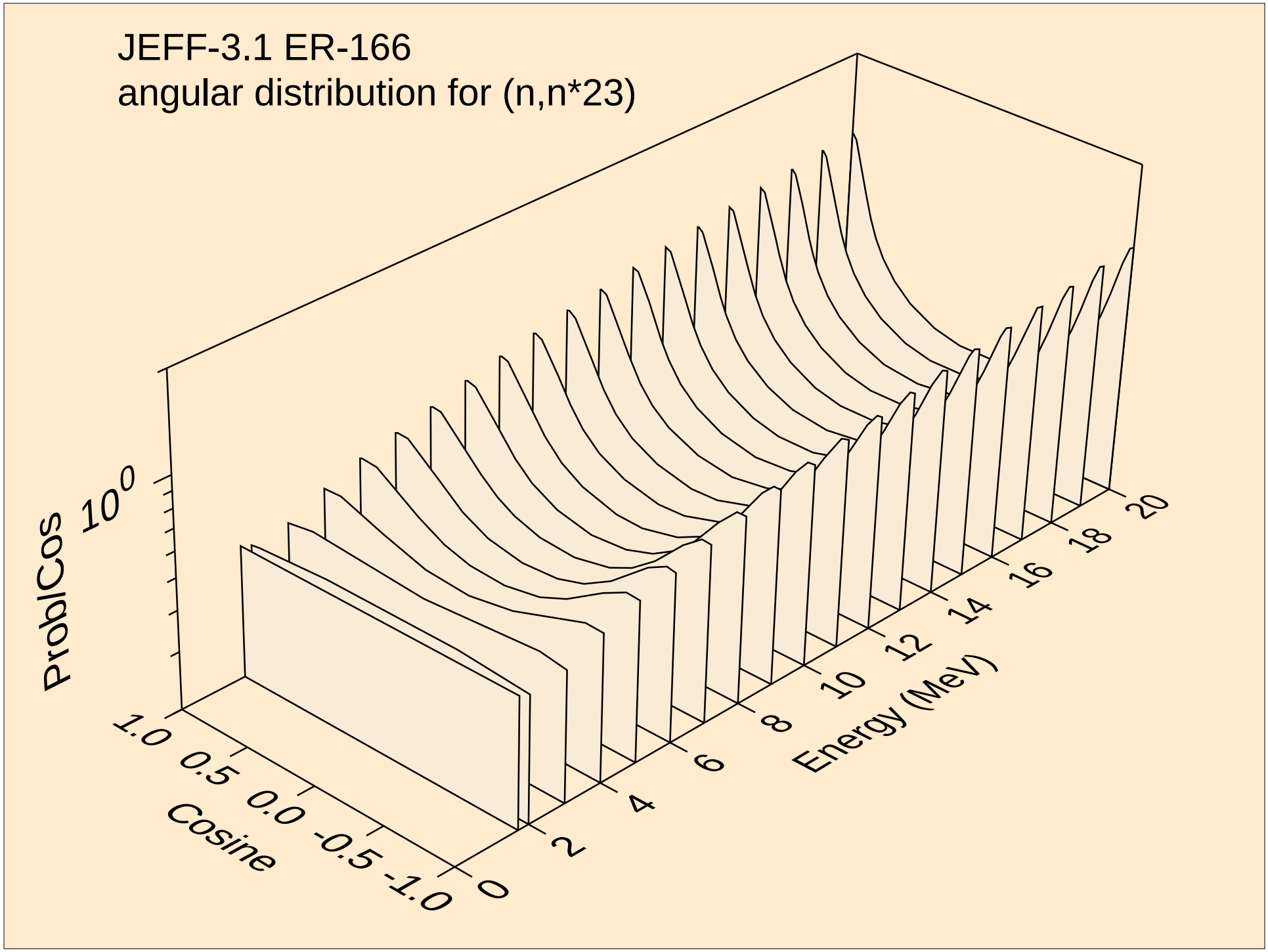

JEFF-3.1 ER-166
angular distribution for (n,n*18)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

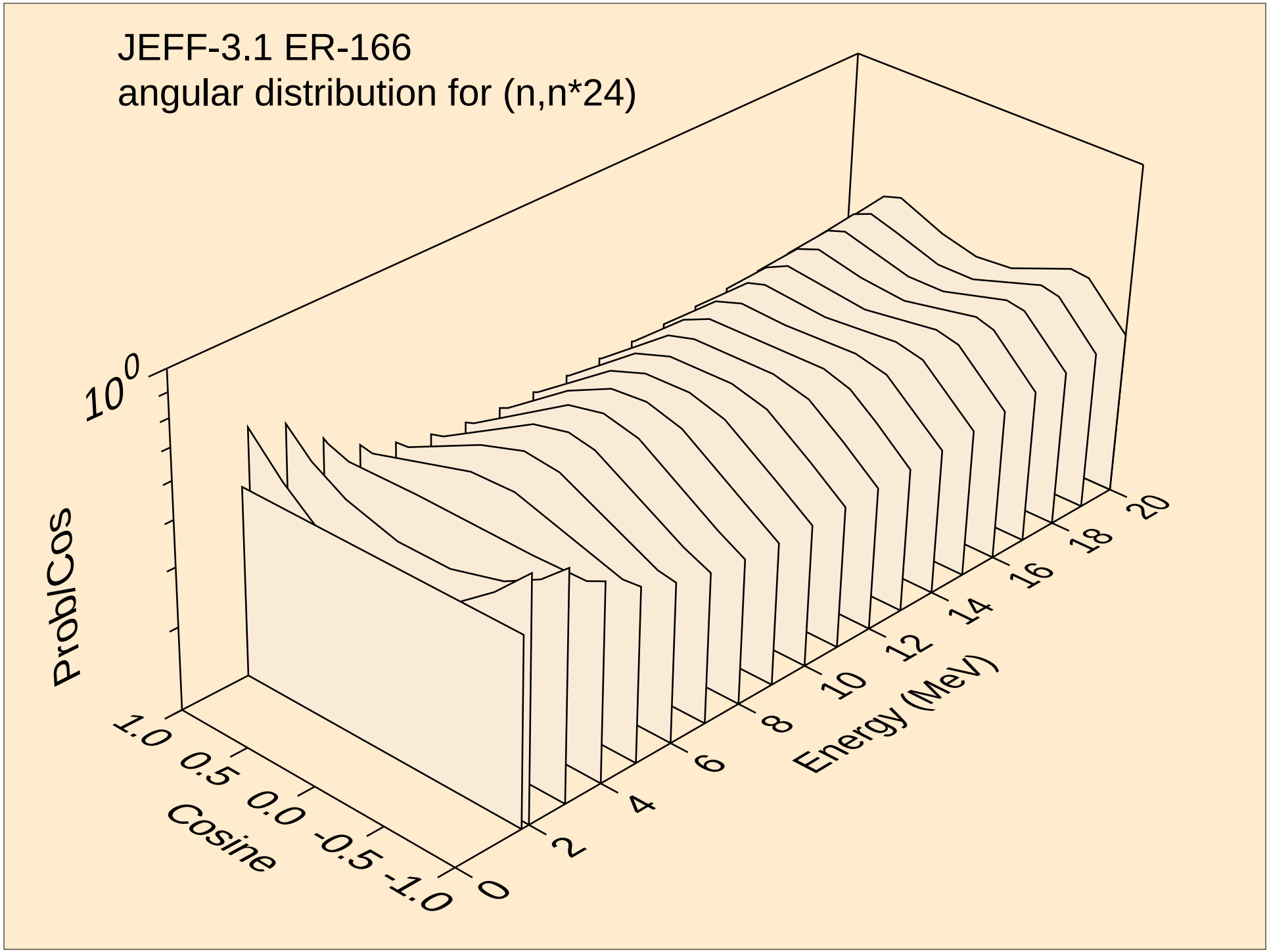

JEFF-3.1 ER-166
angular distribution for (n,n*19)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

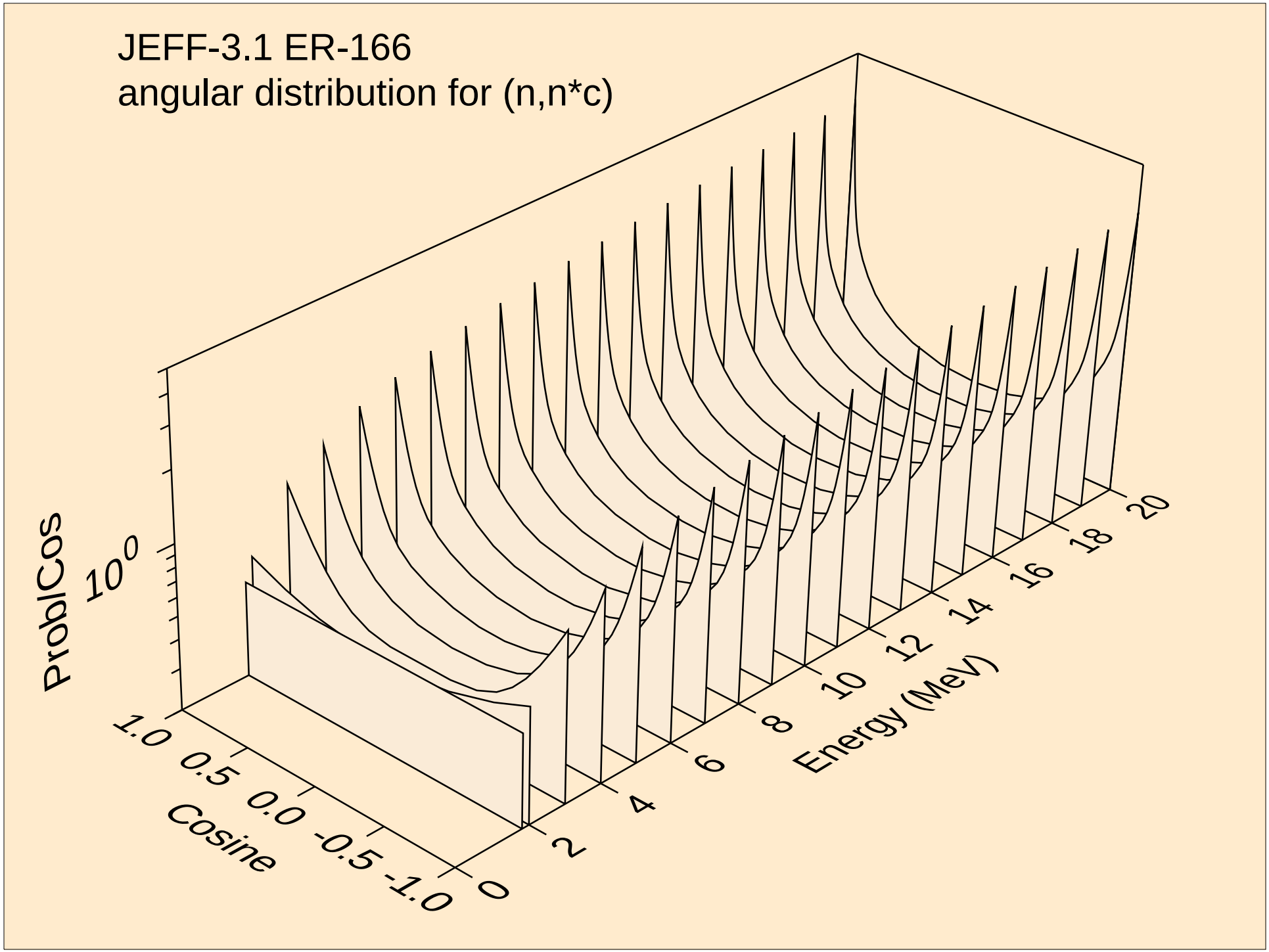

JEFF-3.1 ER-166
angular distribution for (n,n*20)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

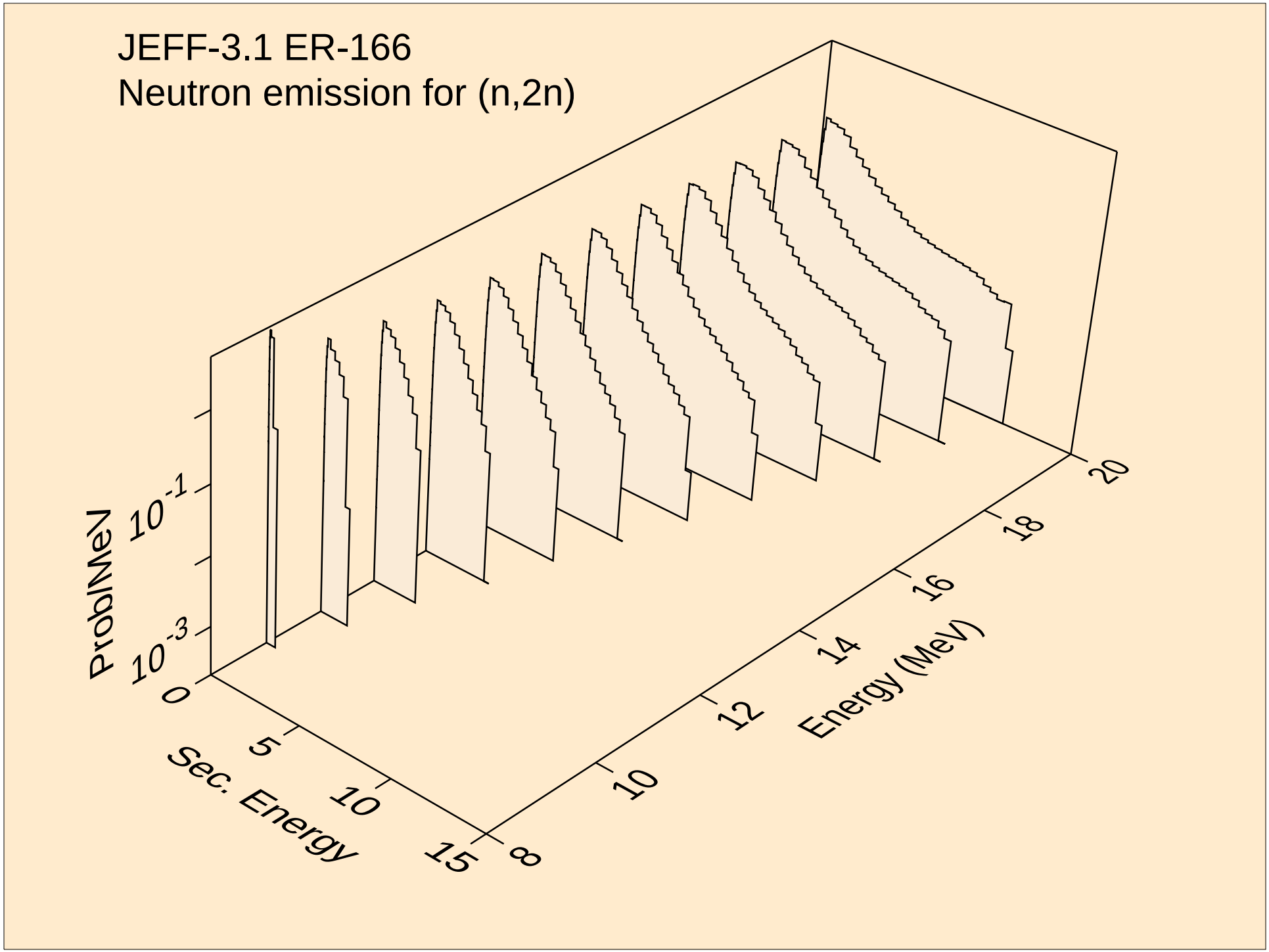

JEFF-3.1 ER-166
angular distribution for (n,n*21)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

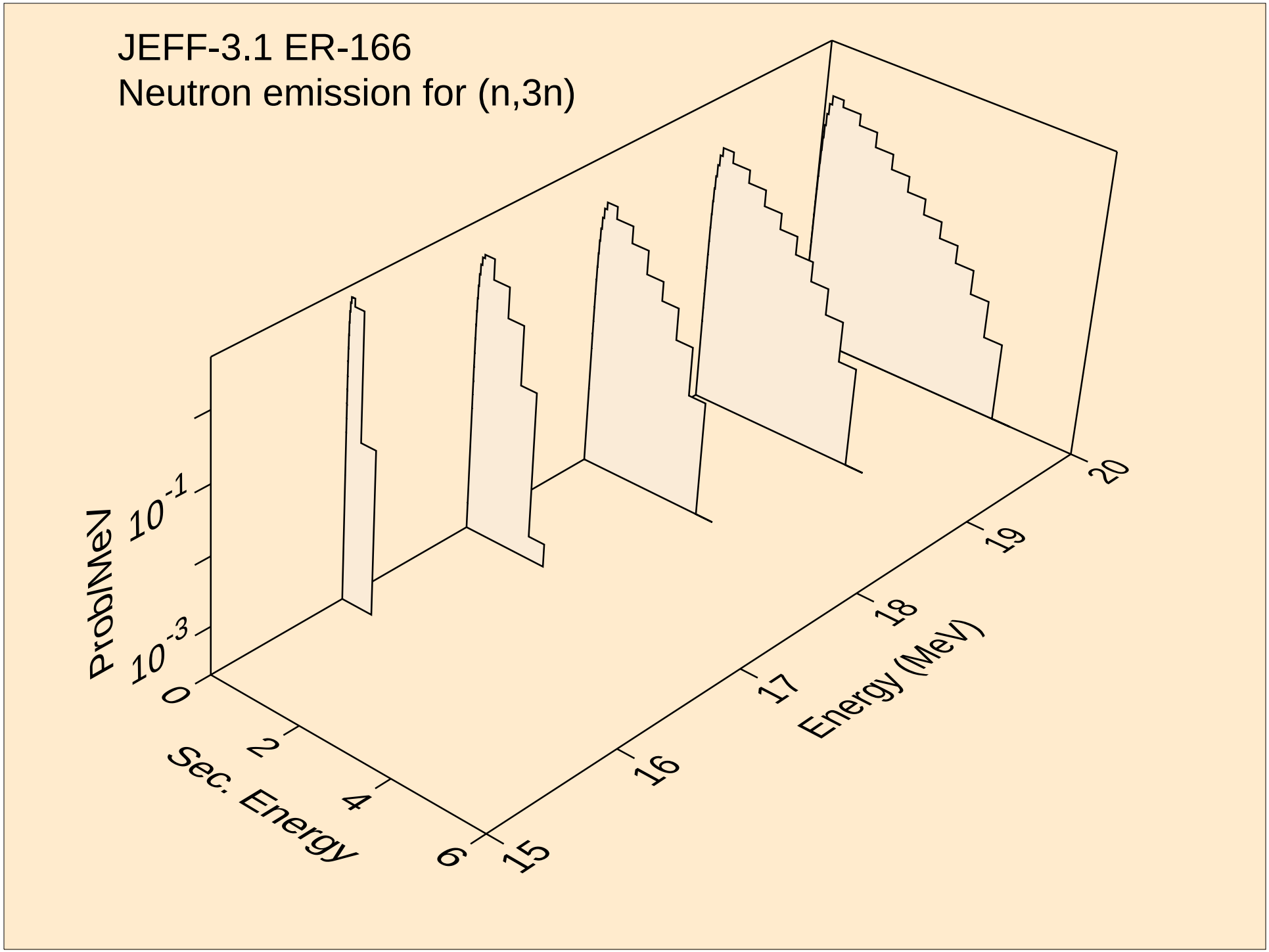

JEFF-3.1 ER-166
angular distribution for (n,n*22)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

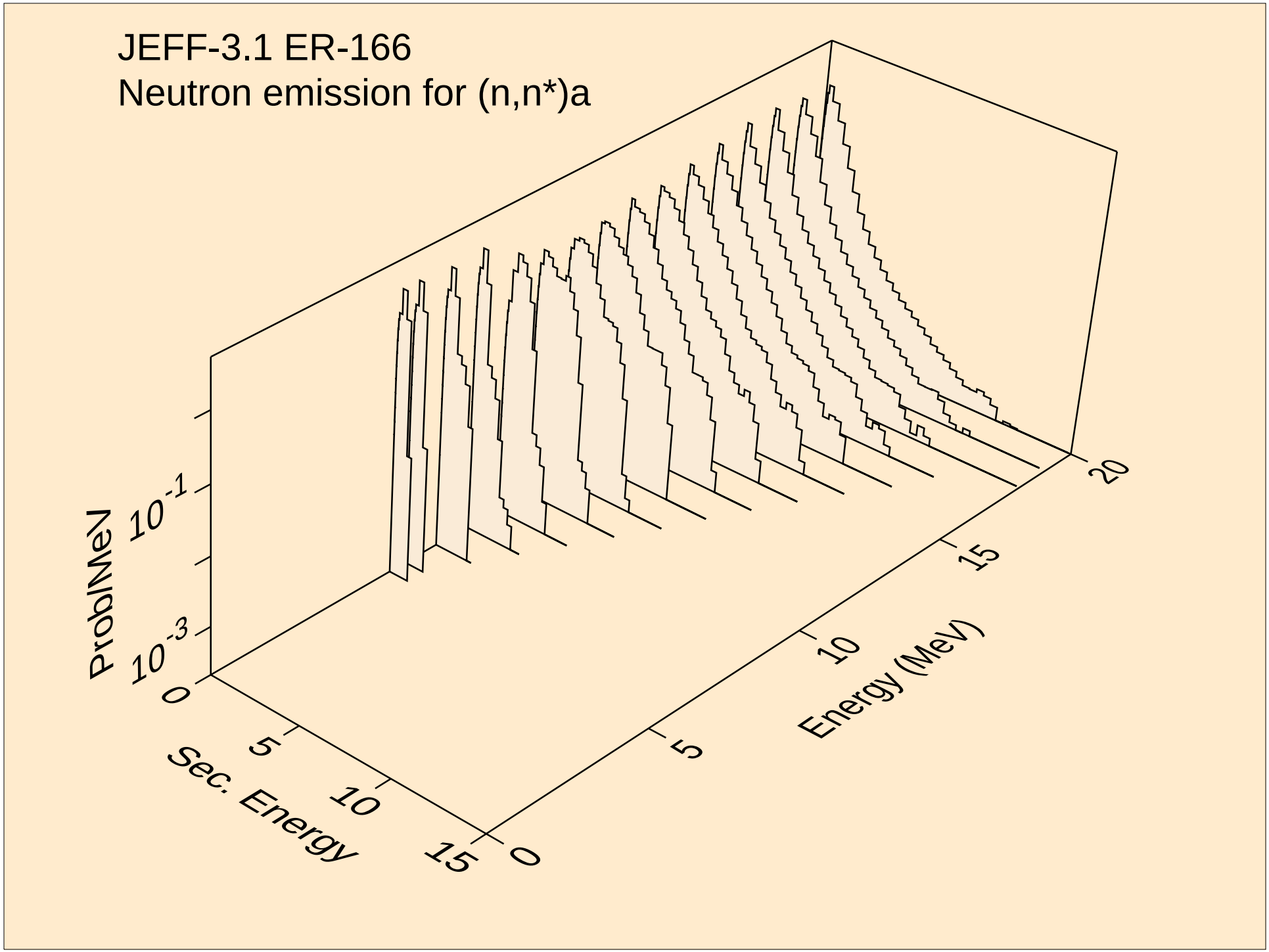

JEFF-3.1 ER-166
angular distribution for (n,n*23)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

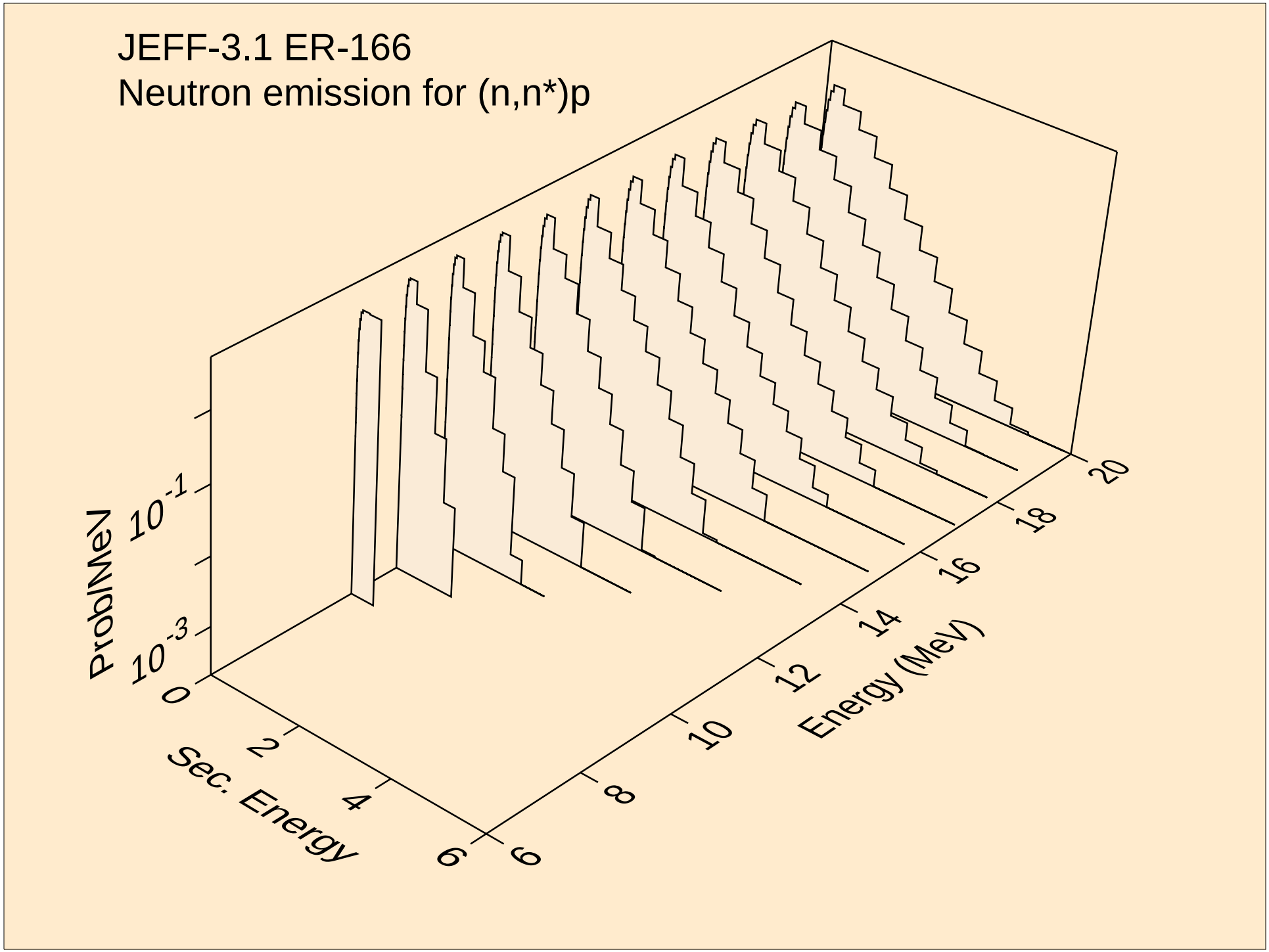

JEFF-3.1 ER-166
angular distribution for (n,n*24)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

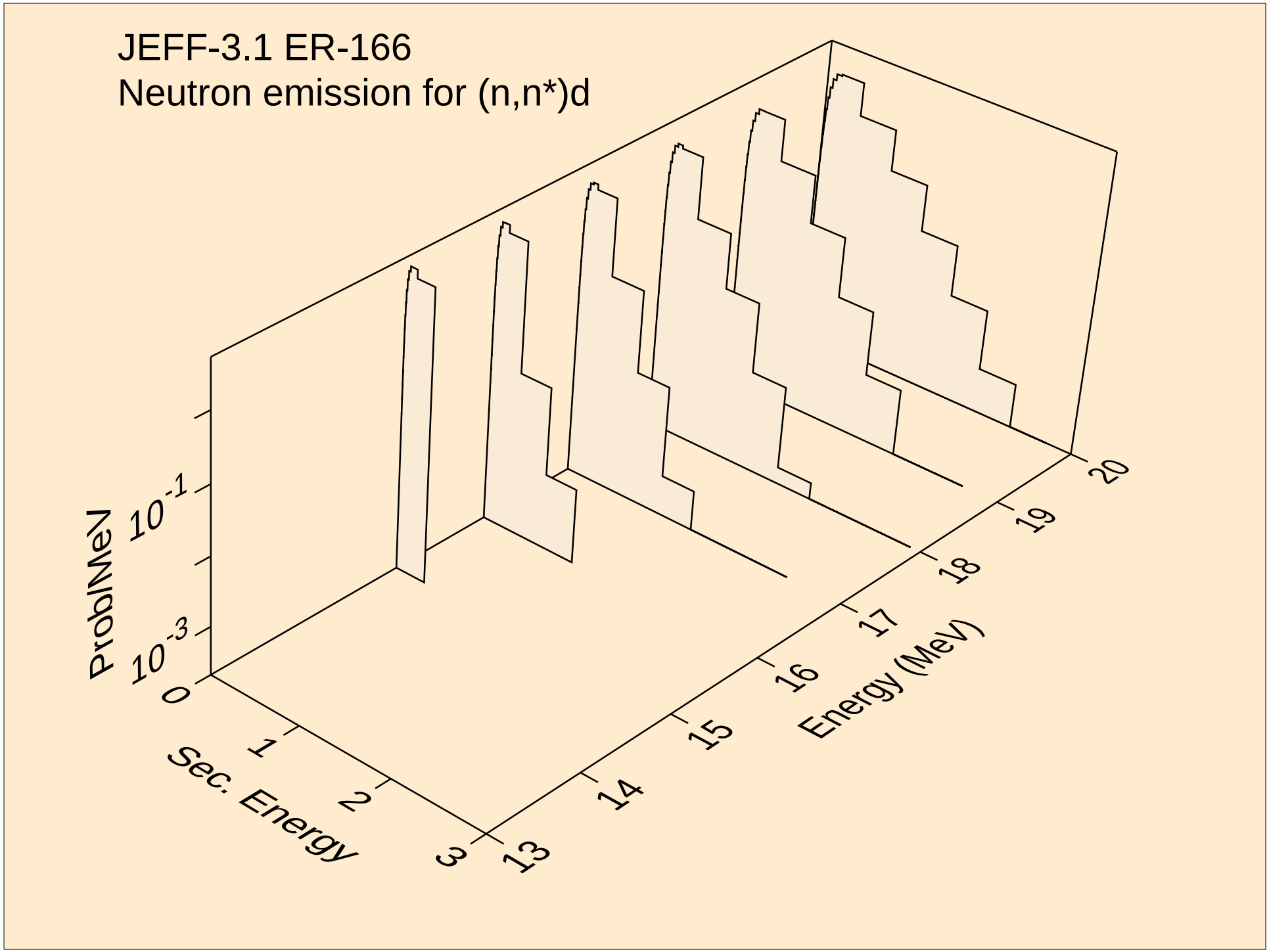

JEFF-3.1 ER-166
angular distribution for (n,n*c)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

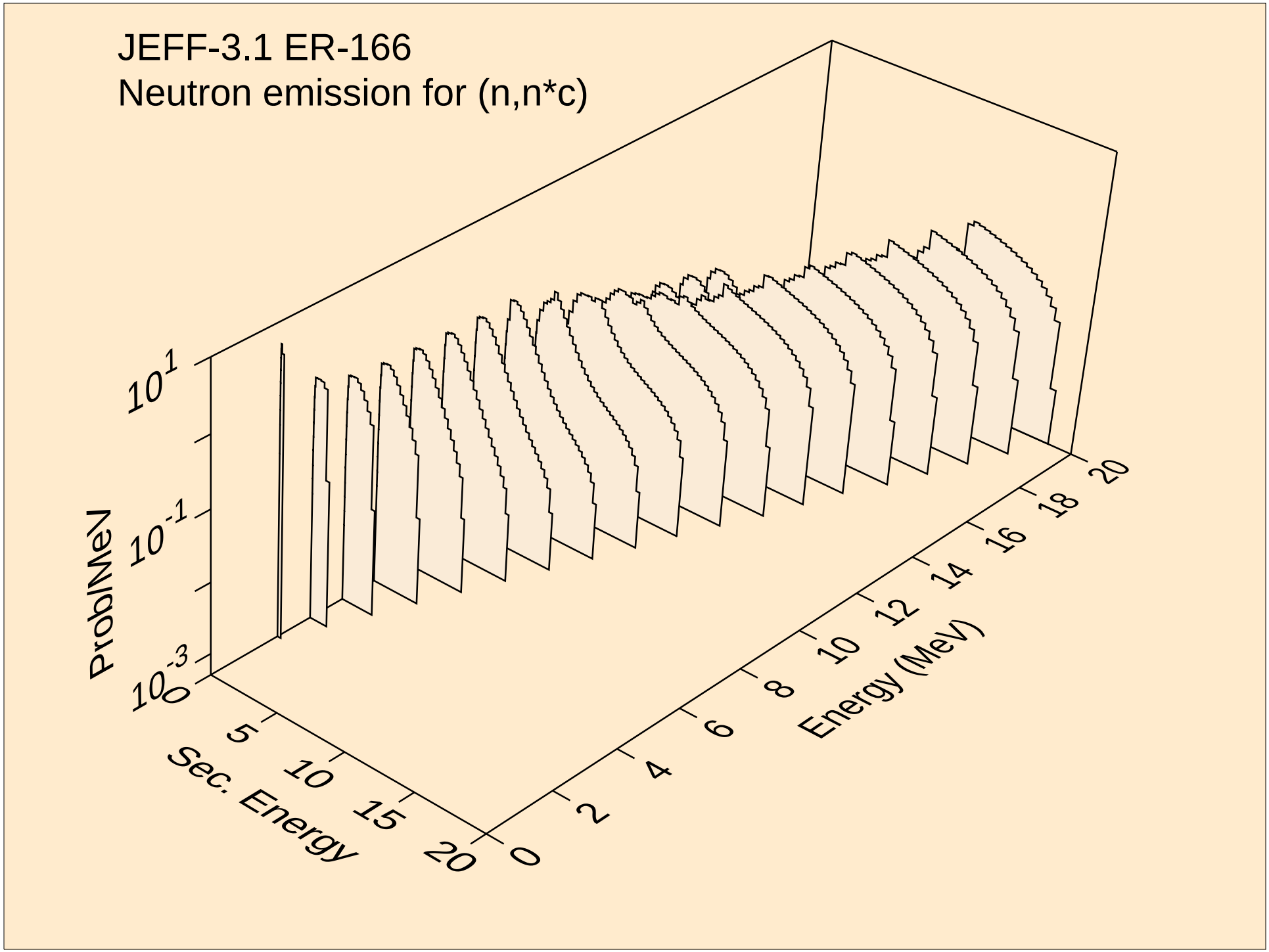

JEFF-3.1 ER-166
Neutron emission for (n,2n)
Prob/MeV
10-1
10-3
0
5
10
15
Sec. Energy
8
10
12
14
16
18
20
Energy (MeV)

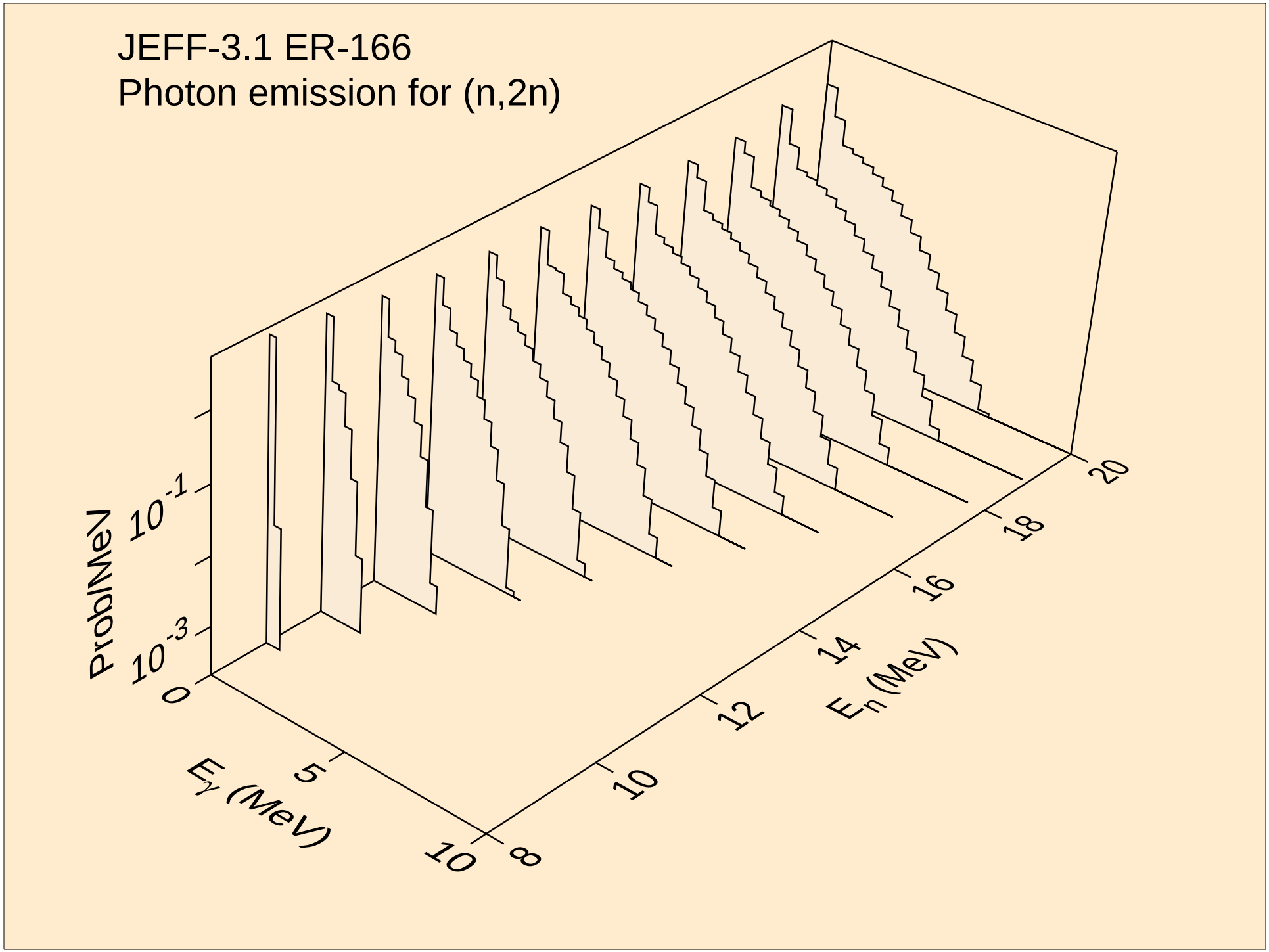

JEFF-3.1 ER-166
Neutron emission for (n,3n)
Prob/MeV
10-1
10-3
0
Sec. Energy
2
4
6
15
16
17
18
19
20
Energy (MeV)

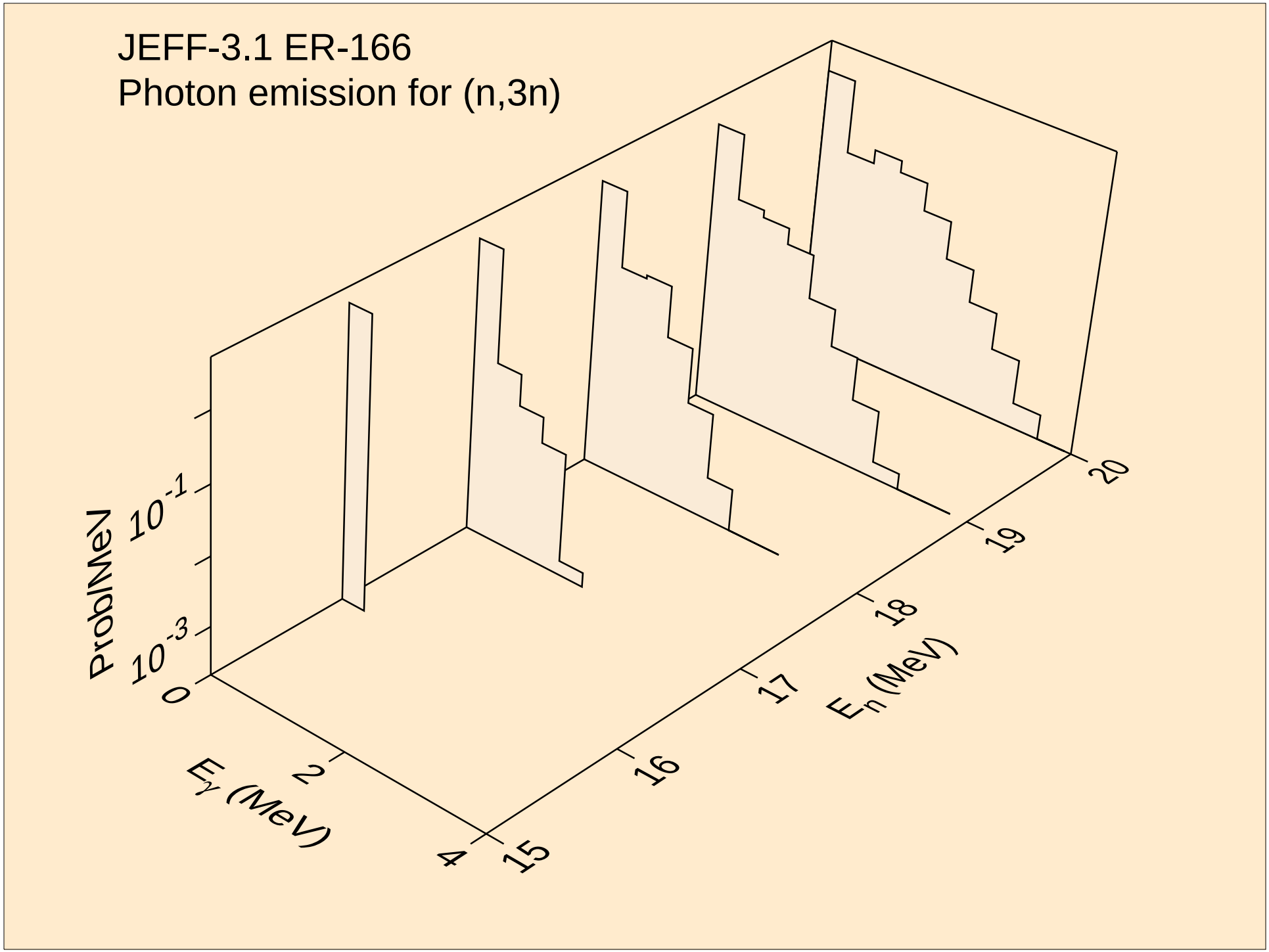

JEFF-3.1 ER-166
Neutron emission for (n,n*)a
Prob/MeV
10-1
10-3
0
5
10
15
Sec. Energy
0
5
10
15
20
Energy (MeV)

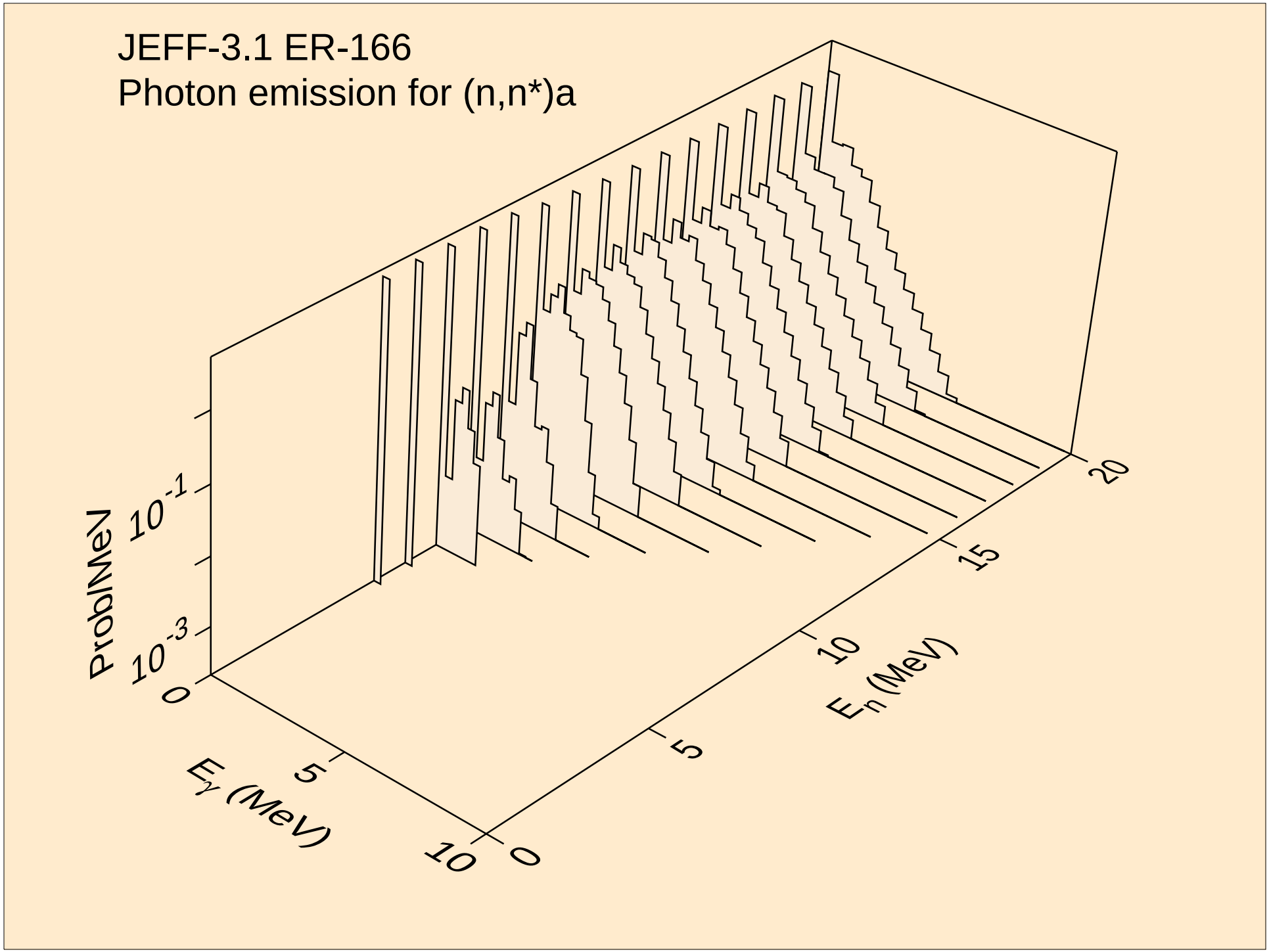

JEFF-3.1 ER-166
Neutron emission for (n,n*)p
Prob/MeV
10^-1
10^-3
0
2
4
6
Sec. Energy
8
10
12
14
16
18
20
Energy (MeV)

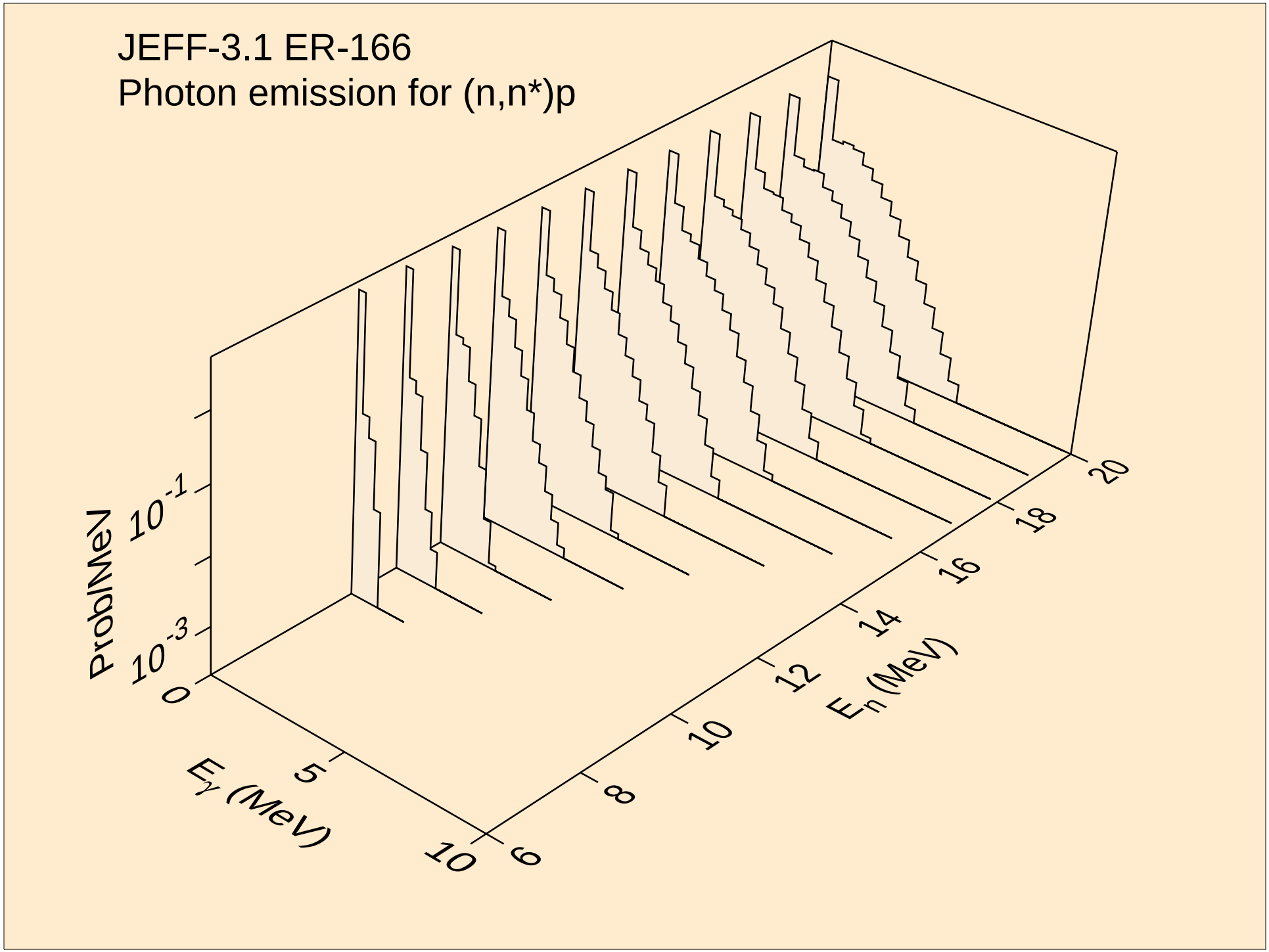

JEFF-3.1 ER-166
Neutron emission for (n,n*)d
Prob/MeV
10-1
10-3
0
Sec. Energy
1
2
3
13
14
15
16
17
18
19
20
Energy (MeV)

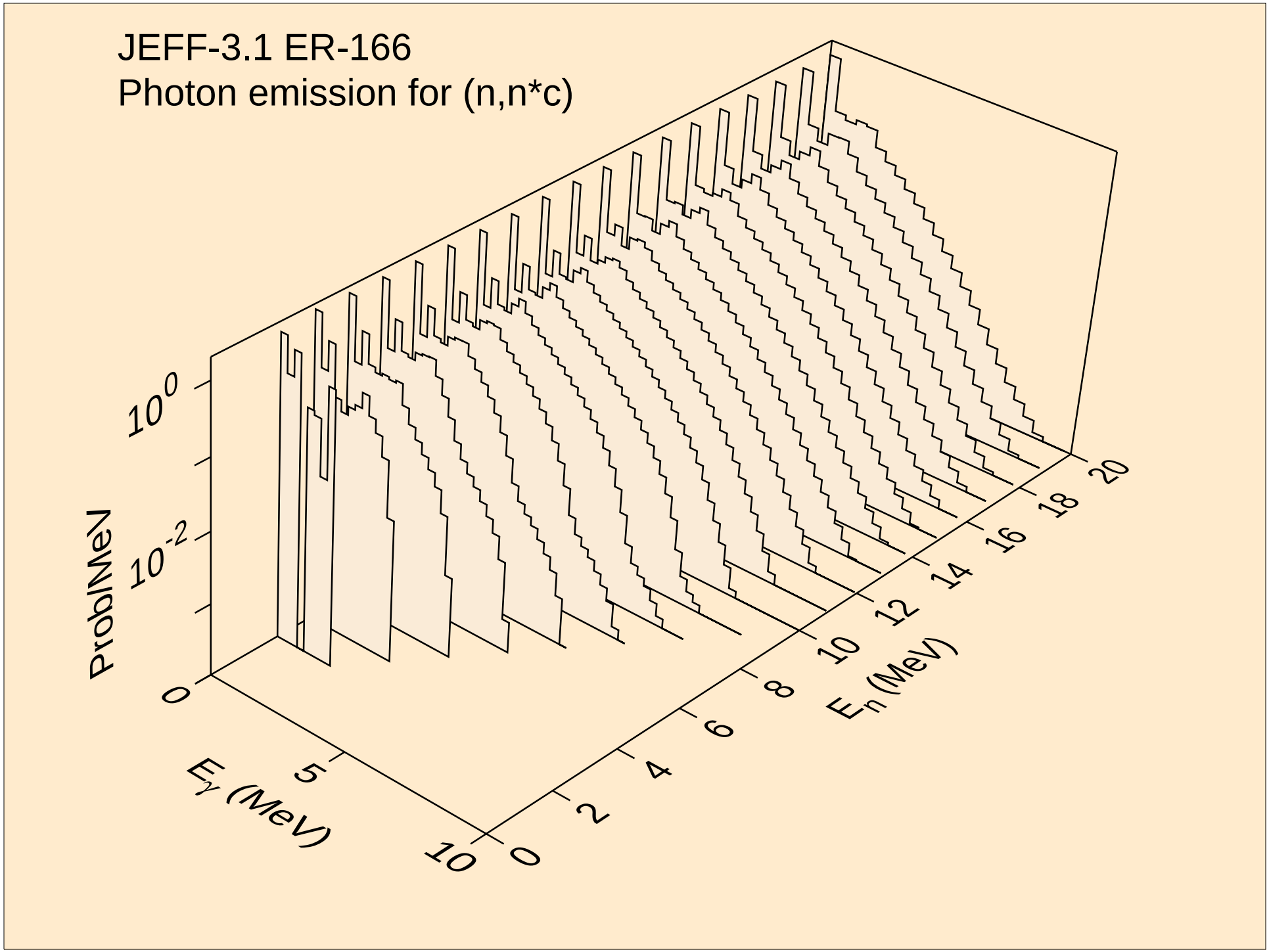

JEFF-3.1 ER-166
Neutron emission for (n,n*c)
Prob/MeV
10^{1}
10^{-1}
10^{-3}
0
5
10
15
20
Sec. Energy
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

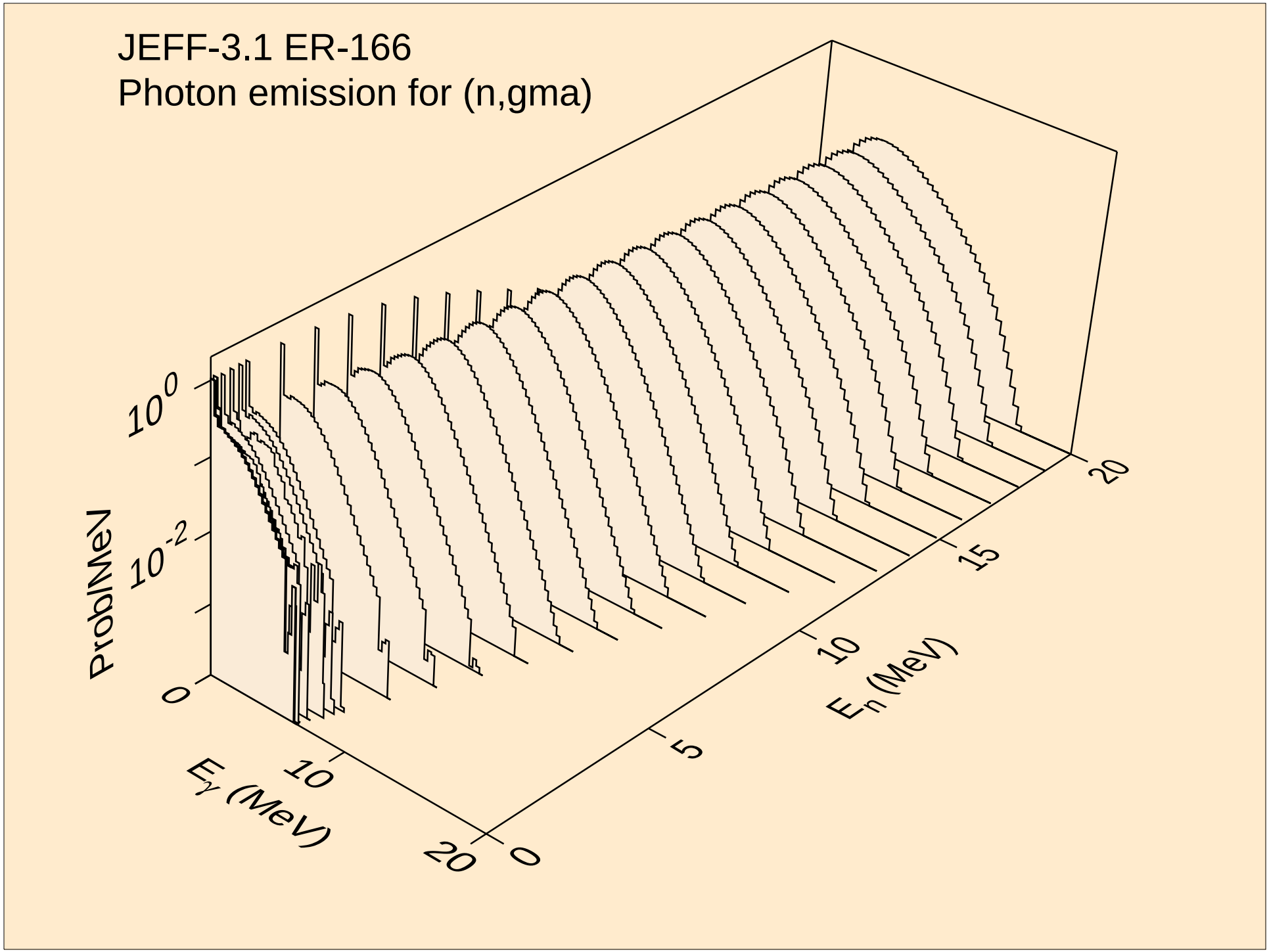

JEFF-3.1 ER-166
Photon emission for (n,2n)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
8
10
12
14
16
18
20
En (MeV)

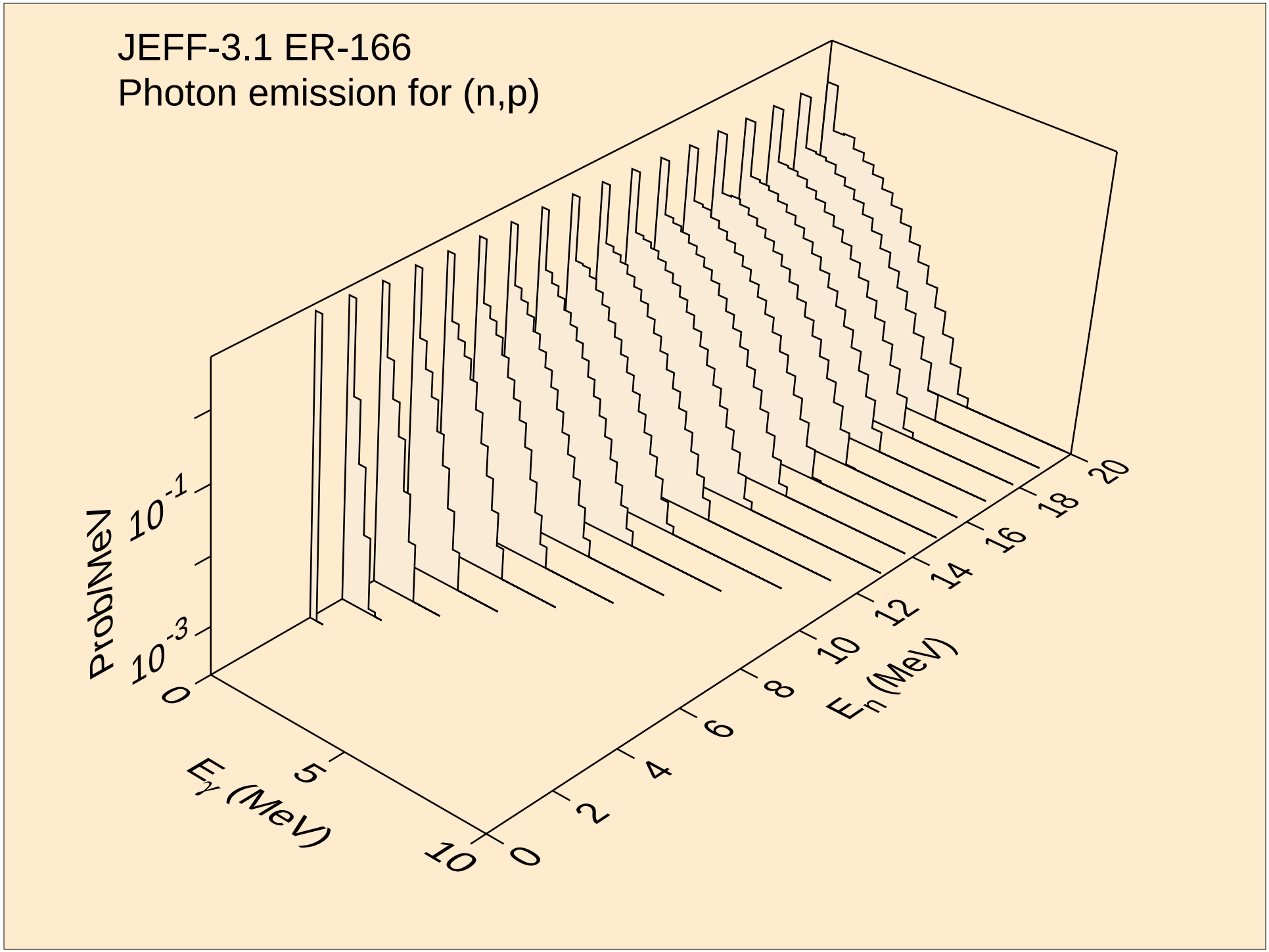

JEFF-3.1 ER-166
Photon emission for (n,3n)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
2
4
15
16
17
18
19
20
En (MeV)

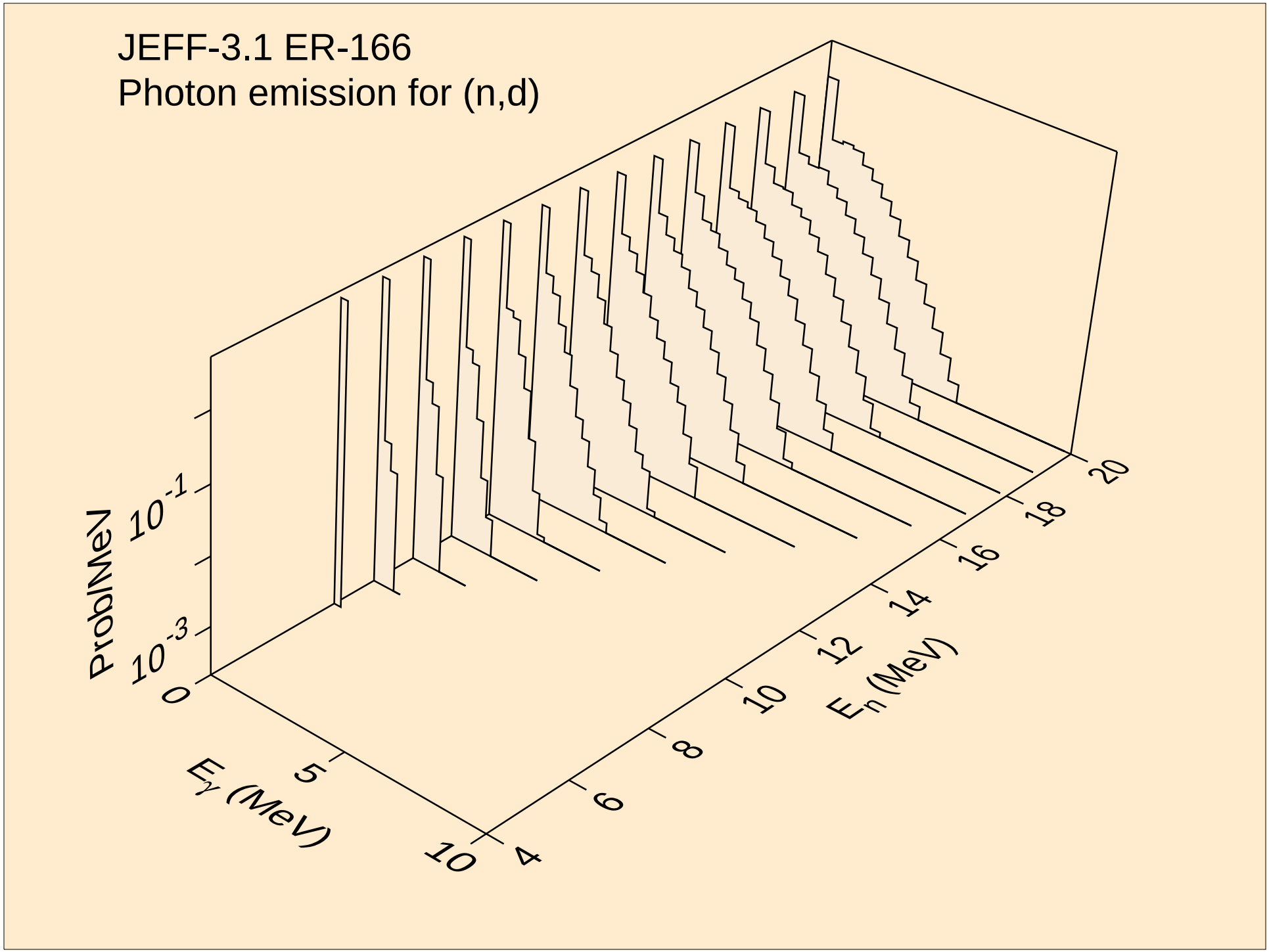

JEFF-3.1 ER-166
Photon emission for (n,n*)a
Prob/MeV
10-1
10-3
0
5
10
Eγ (MeV)
0
5
10
15
20
En (MeV)

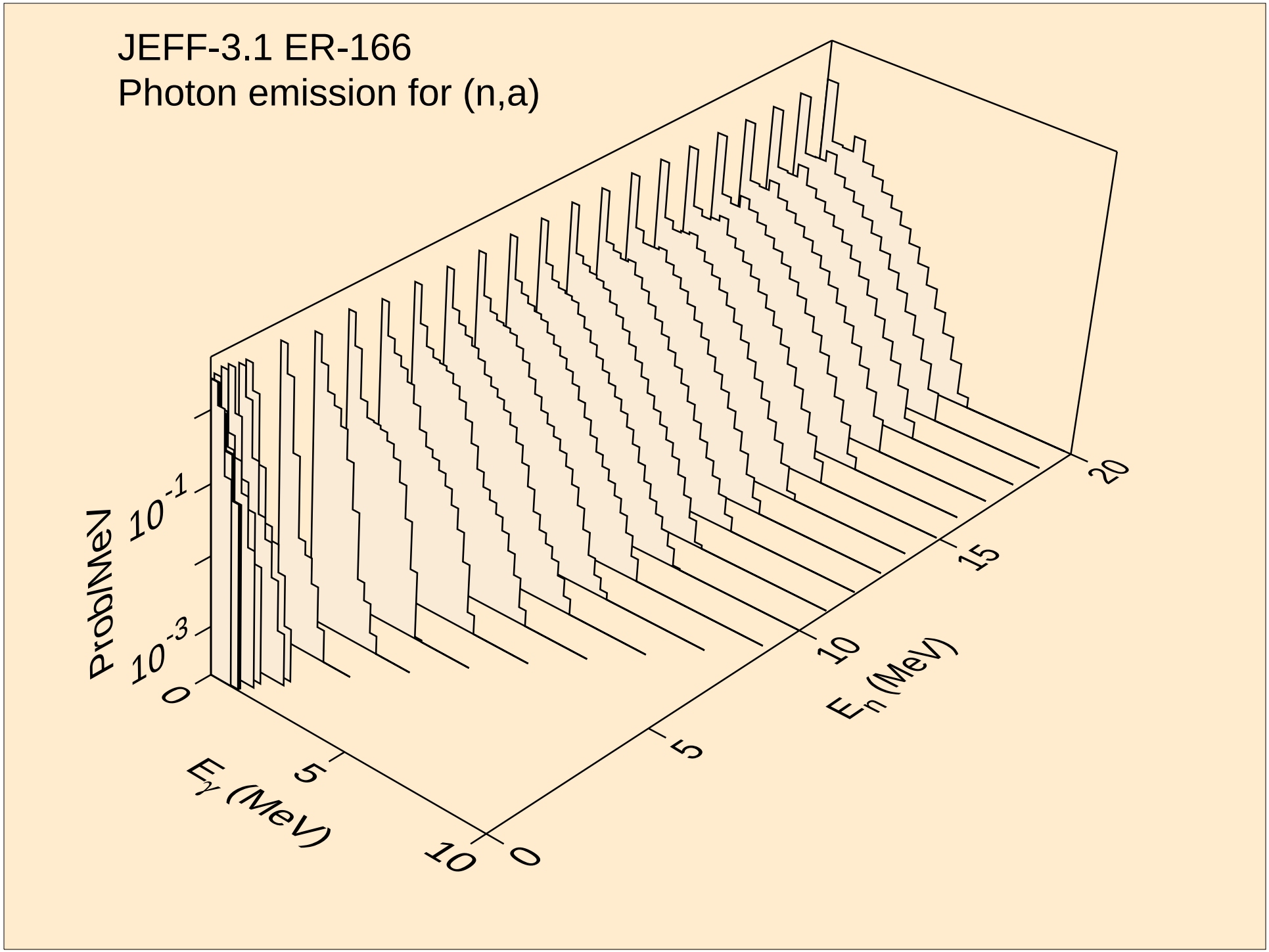

JEFF-3.1 ER-166
Photon emission for (n,n*)p
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
6
8
10
12
14
16
18
20
En (MeV)

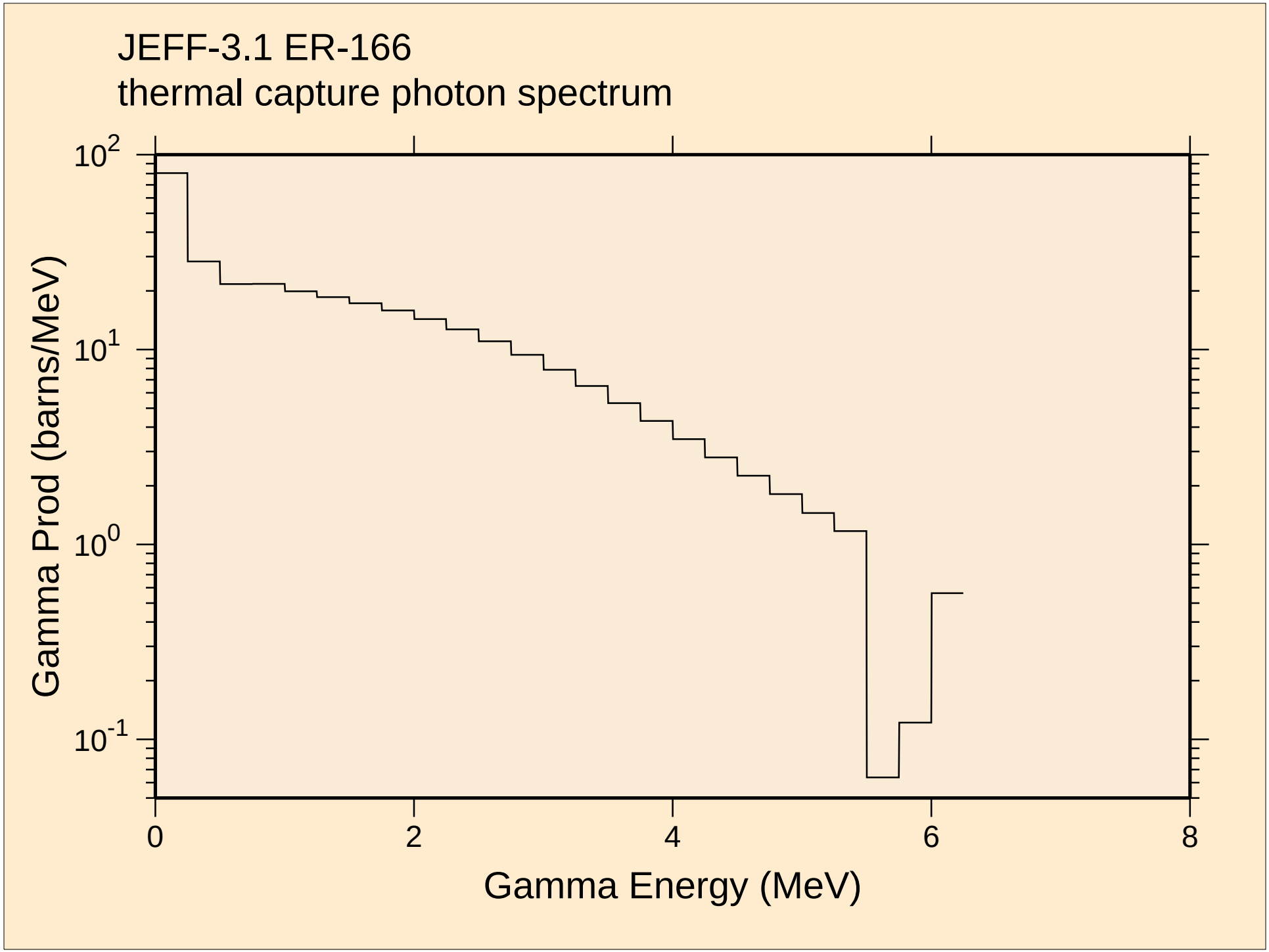

JEFF-3.1 ER-166
Photon emission for (n,n*c)
Prob/MeV
10^0
10^{-2}
0
5
10
E_γ (MeV)
0
2
4
6
8
10
12
14
16
18
20
E_n (MeV)

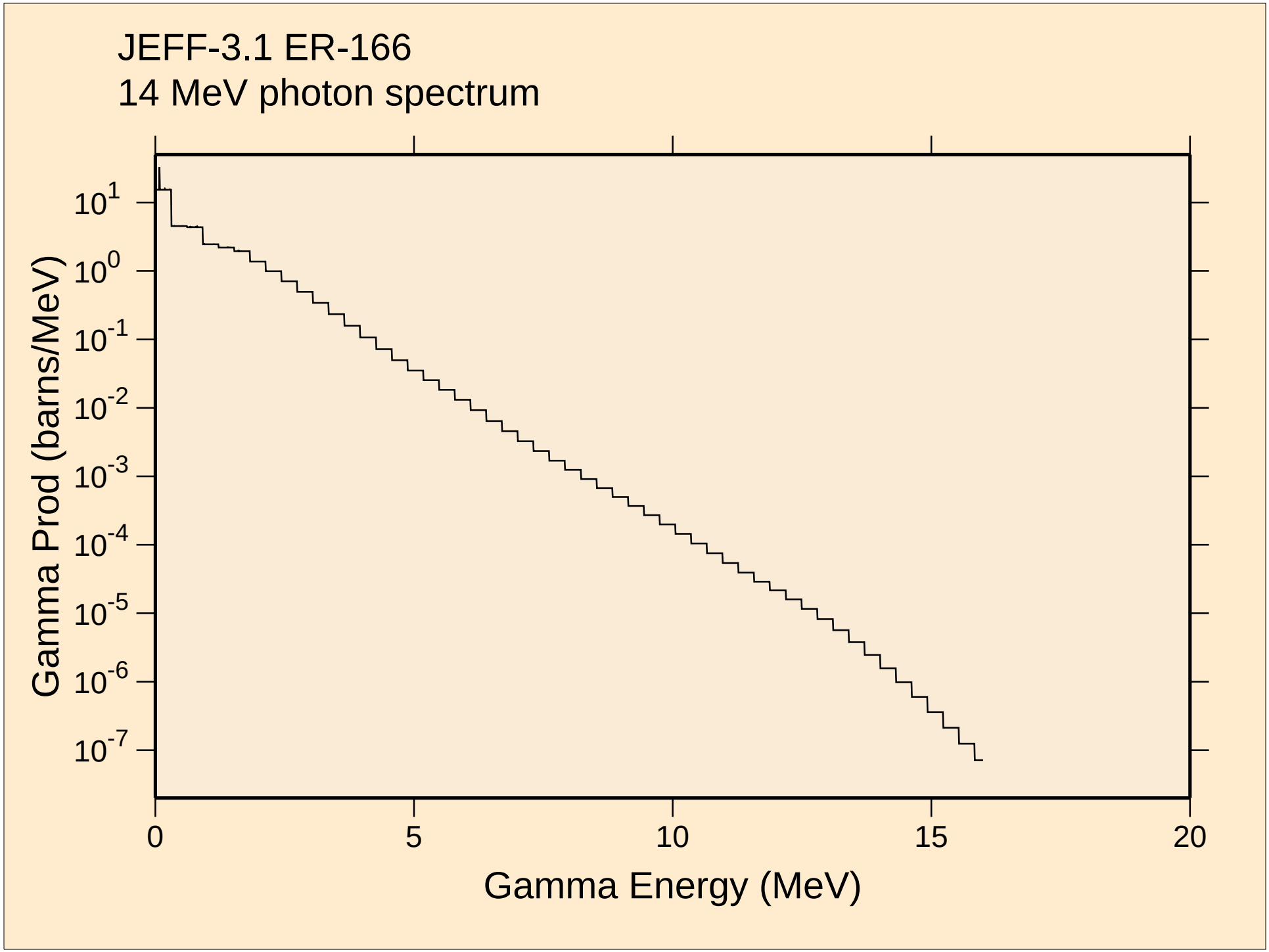

JEFF-3.1 ER-166
Photon emission for (n,gma)
Prob/MeV
10^{0}
10^{-2}
0
10
E_γ (MeV)
20
0
5
10
15
20
E_n (MeV)


JEFF-3.1 ER-166
Photon emission for (n,p)
Prob/MeV
10^-1
10^-3
0
E_γ (MeV)
0
5
10
E_n (MeV)
0
2
4
6
8
10
12
14
16
18
20


JEFF-3.1 ER-166
Photon emission for (n,d)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
En (MeV)
4
6
8
10
12
14
16
18
20


JEFF-3.1 ER-166
Photon emission for (n,a)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
0
5
10
15
20
En (MeV)


JEFF-3.1 ER-166
thermal capture photon spectrum
Gamma Prod (barns/MeV)
10^2
10^1
10^0
10^{-1}
0
2
4
6
8
Gamma Energy (MeV)


JEFF-3.1 ER-166
14 MeV photon spectrum
Gamma Prod (barns/MeV)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
0
5
10
15
20
Gamma Energy (MeV)